

1. Online detection of liquid lithium lead alloy in tritium content sensor [Machine Translation].

By Mei, Huaping; Wu, Yican; Huang, Qunying; Wu, Qingsheng; Chen, Jianwei

From [Faming Zhuanli Shenqing \(2016\)](#), CN 105842323 A 20160810, Language: Chinese, Database: CAPLUS

[Machine Translation of Descriptors]. The present invention provides an online detection liq. lithium lead alloy tritium content sensor, including the sample chamber, chamber, a ref. electrode, a working gas tank valve, vacuum pump, each part. The present invention utilizes the tritium in sample chamber wall surface of diffusion penetration, so that liq. lithium lead alloy and sample chamber of tritium reach equil., and then through the measurement sample chamber of tritium content to obtain liq. lithium lead alloy tritium content. The present invention by providing a ref. chamber reduce liq. lithium lead alloy neutron radiation activation products to tritium content detection error. The invention has the advantages that: (1) it can achieve liq. lithium lead alloy tritium content online detection; (2) avoid the carrier gas from liq. lithium lead alloy tritium extn. in carrying, detection process is relatively simple; (3) in the sample chamber directly measure tritium, reduce loss and contamination; (4) can be synchronously detect liq. lithium lead alloy γ radiation field. The present invention is applicable to fusion reactor liq. lithium lead cladding loop tritium content online detection.

~0 Citings

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2. Experimental determination of solubility values for hydrogen isotopes in eutectic Pb-Li

By Alberro, G.; Penalva, I.; Sarrionandia-Ibarra, A.; Legarda, F.; Esteban, G. A.

From [Fusion Engineering and Design \(2015\)](#), 98-99, 1919-1923. Language: English, Database: CAPLUS, DOI:10.1016/j.fusengdes.2015.05.060

Hydrogen isotopes soly. in eutectic lithium-lead alloys is really important for the design of breeding blanket components that use this breeding material. The detn. of the magnitude and kinetics of the tritium flux from the blanket to the helium cooling loop, along with the design of future tritium extn. systems of the breeding alloy or the He coolant purifn. system, will be defined on basic transport parameters such as soly. The unacceptable scattering of Sieverts' const. values in the historical measurements given by different exptl. techniques, suggests that this is a very important and unresolved issue. In this work, it has been exptl. evaluated, using absorption and desorption techniques. The different measurement campaigns have been carried out in the temp. range from 523 to 922 K and in the pressure range from 1 to 10^5 Pa. This paper describes the work carried out in the prepn. of the facility, the theor. model developed to process the different results obtained by means of absorption and desorption runs. Final results obtained during several campaigns of measurements are provided. The obtained values of hydrogen soly. through the different campaigns show a similar value for the Sieverts' const., and therefore, a very little value for the activation energy in the soln. process. Results are compared and discussed. The proposed correlation for hydrogen Sieverts' const. in Pb-Li from these tests is $K_S [\text{mol m}^{-3} \text{Pa}^{-1/2}] = 8.64 \times 10^{-3} \exp(-0.9/RT)$, R in ($\text{kJ K}^{-1} \text{mol}^{-1}$).

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3. Method for preparation of lithium-lead alloy for nuclear reactor

By Zhang, Maolian; Wu, Yican; Huang, Qunying; He, Xiaoxiong; Zhang, Yongfeng; Wang, Yulian; Li, Yong; Gao, Weixia; He, Enjie; Feng, Jie; et al

From [Faming Zhuanli Shenqing \(2015\)](#), CN 104451252 A 20150325, Language: Chinese, Database: CAPLUS

In the title lithium-lead alloy, lead serves as matrix, the mass percent of Li is $0.68 \pm 0.05\%$, total impurity content is less than 300 ppm, and the content of single impurity element (Fe, Mn or Al) is less than 5 ppm; and the lithium-lead alloy does not contain elements (N, Ni, Mo, Nb, Co and Cu) which generate radioactive products under neutron irradiation. The title prepn. method includes (1) uniformly mixing Li powder and Pb powder in a high-purity argon gas environment; (2) adding the mixed Li powder and Pb powder into a smelting furnace in batches, heating and melting, stirring continuously and electromagnetically, alloying Li and Pb while releasing a lot of heat, charging, melting and heat-absorbing, controlling temp. to not exceed 470°C , stirring for 15-25 min, and filtering $400-450^\circ\text{C}$ lithium-lead alloy to remove high-m.p. Li and Pb compds.; and (4) vacuum fusion casting the filtered lithium-lead alloy at $270-320^\circ\text{C}$ to obtain alloy cast ingot. Expts. show that the inventive lithium-lead alloy material integrates three functions of neutron multiplication, tritium breeding and cooling, and is suitable for the field of nuclear industry, specifically the field of fusion reactor.

~0 Citings

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4. Method for preparation of lithium-lead alloy Li17Pb83 for nuclear industry

By Zhang, Maolian; Wu, Yican; Huang, Qunying; Xu, Wanxiang; Zhang, Yongfeng; Feng, Jie; He, Enjie; Zhu, Zhiqiang; Gao, Sheng; Li, Chunjing

From [Faming Zhuanli Shenqing \(2015\)](#), CN 104328294 A 20150204, Language: Chinese, Database: CAPLUS

The title method includes processing raw materials Pb and Li in high-purity argon gas environment to obtain powder with particle size of 150-250 meshes; in high-purity argon gas environment, loading Pb powder and Li powder into resp. feed hopper, loading a part of Pb powder into a stirring tank, performing mech. stirring, allowing Li powder and Pb powder into the stirring tank through resp. feed hopper, and mixing uniformly; cleaning a smelting furnace and a casting mold; in high-purity argon gas environment, adding the mixed Pb powder and Li powder into the smelting furnace in batches, heating for melting while performing continuous electromagnetic stirring, Li and Pb being subjected to alloying to generate large amt. of heat, the raw materials melting to absorb heat, controlling the temp. to be not higher than 470°C, maintaining the stirring for 15-25 min, and standing the melt at 400-450°C for 1-3 h; in high-purity argon gas environment, filtering **lithium-lead alloy** $\text{Li}_{17}\text{Pb}_{83}$ of 400-450°C via a filter screen to remove high-m.p. Li and Pb compd.; and vacuum casting at 270-320°C via the special casting mold to obtain an **alloy** ingot. The method of the present invention solves the key problems of component segregation, difficult temp. control and difficult Li content control in **alloy** prepn. process.

~0 Citings

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5. Tritium migration in HCLL and WCLL blankets: impact of tritium solubility in liquid Pb-17Li

By Santucci, Alessia; Ciampichetti, Andrea; Demange, David; Franza, Fabrizio; Tosti, Silvano
From [IEEE Transactions on Plasma Science \(2014\), 42\(4\), 1053-1057](#). Language: English, Database: CAPLUS,
DOI:10.1109/TPS.2014.2305759

The next generation of fusion power plants (DEMO) should rely on a breeding blanket (BB) able to efficiently convert the neutrons kinetic energy into heat, to ensure the tritium self-sufficiency and to adequately shield the toroidal field coils from neutrons and gamma rays. The eutectic **lithium-lead alloy** is a consolidate liq. blanket material, which simultaneously includes the breeder (Li) and the neutron multiplier (Pb). The assessment of the tritium inventory inside the blanket and its environmental release requires knowledge of the hydrogen isotopes interactions with blanket materials, in particular the hydrogen soly. in **lithium-lead**, which is defined by means of the hydrogen Sievert's const. Several expts., aiming to det. the hydrogen isotopes soly. in **lithium-lead**, have been performed in the past giving values of the temp.-dependent Sieverts' const., K_S , distributed in a wide range (covering about two orders of magnitude on the Arrhenius plot). Starting from a literature review of the K_S values, this paper provides a parametric anal. for the most influencing parameters related to tritium migration in helium-cooled and water-cooled **lead-lithium** DEMO BBs. This anal. has been performed using the computational code FUS-TPC for several operative scenarios and considering the different K_S values. This paper demonstrates that the tritium Sieverts' const. in Pb-17Li has a great impact on the assessment of tritium losses, whose value can spread in more than one order of magnitude. Furthermore, the anal. suggests suitable permeation redn. factors to be adopted in the different scenarios as well as the need of addressing new accurate expts. on the soly. const.

~2 Citings

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6. Impact of tritium solubility in liquid Pb-17Li on tritium migration in HCLL and WCLL blankets

By Santucci, A.; Ciampichetti, A.; Demange, D.; Franza, F.; Tosti, S.
From [IEEE Symposium on Fusion Engineering \(2013\), 25th, 899-902](#). Language: English, Database: CAPLUS

The next generation of fusion power plants (DEMO) should rely on a breeding blanket able to efficiently convert into heat the neutrons kinetics energy, to ensure the tritium self-sufficiency and to adequately shield the Toroidal Field Coils from neutrons and gamma rays. The eutectic **lithium-lead alloy** is a consolidate liq. blanket material which simultaneously includes the breeder (Li) and the neutron multiplier (Pb). The assessment of the tritium inventory inside the blanket and its environmental release requires the knowledge of the hydrogen isotopes interactions with blanket materials, in particular the hydrogen soly. in **lithium-lead** which is defined by means of the hydrogen Sievert's const. Several expts., aiming to det. the hydrogen isotopes soly. in **lithium-lead**, have been performed in the past giving values of the temp.-dependent Sieverts' const., K_S , distributed in a wide range (covering about two orders of magnitude on the Arrhenius plot). Starting from a literature review of K_S values, this work provides a parametric anal. for the most influencing parameters related to tritium migration in Helium-Cooled and Water-Cooled **Lead-Lithium** DEMO breeding blankets. This anal. has been performed by using the computational code FUS-TPC for several operative scenarios and considering the different K_S values. This study demonstrates that the tritium Sieverts' const. in Pb-17Li has a great impact on the assessment of tritium losses, whose value can spread in more than one order of magnitude. Furthermore, the anal. suggests suitable permeation redn. factors to be adopted in the different scenarios as well as the need of addressing new accurate expts. on the soly. const.

~0 Citings

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7. Tritium technologies for PbLi based breeding blankets

By Ciampichetti, Andrea; Ricapito, Italo
Edited By: Tosti, Silvano; Ghirelli, Nicolas
From [Tritium in Fusion \(2013\)](#), 87-124. Language: English, Database: CAPLUS

A review. A **lead-lithium** based breeding blanket for DEMO and its corresponding Test Blanket Module (TBM) to be tested in ITER is being developed in EU. The same approach is pursued in other countries involved in the development of fusion nuclear technologies. The eutectic **lithium lead alloy** (Pb-16Li) includes the tritium breeder material (Li) and the neutron multiplier (Pb) and, used in liq. form, it can be recirculated outside the blanket module to facilitate the tritium extn. and the **alloy** purifn. However, it shows also some drawbacks. In fact, besides the issues related to the MHD (MHD) effects and the compatibility of liq. **lead lithium alloy** with structural materials, it is known that the tritium Sieverts' const. in Pb-16Li is low. As a consequence, an high tritium permeation rate from the liq. metal to the primary cooling system is expected, at least in absence of efficient tritium permeation barriers. This aspect affects the whole blanket tritium cycle, whose main steps consist of tritium extn. from the liq. breeder (TES, Tritium Extn. System) and tritium removal from He primary coolant (CPS, Cooling Purifn. System). This chapter is focused on the description of tritium processing systems and tritium technologies related to the adoption of the **lead-lithium alloy** in DEMO breeding blankets. The first section describes the DEMO fuel cycle giving a particular accuracy to the description of the breeding blanket part. The second section introduces the hydrogen isotopes transport parameters in Pb-16Li which have a strong impact on the process strategy of the blanket fuel cycle. Then, the above-mentioned tritium processing systems and technologies will be described in detail. In particular, an assessment of the tritium systems that can meet the requirements of a **lead-lithium** based DEMO blanket is carried out presenting the suitable technologies together with their drawbacks and advantages.

~0 Citings

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8. Preliminary study of hydrogen dissolution behavior in liquid **lithium-lead alloy**

By Xie, Bo; Weng, Kui-ping; Hou, Jian-ping; Yang, Guang-ling; Xia, Xiu-long
From [Xiyou Jinshu Yu Yingzhi Hejin \(2013\)](#), 41(6), 25-28. Language: Chinese, Database: CAPLUS

Preliminary measuring and anal. were made of hydrogen concn. in liq. **lithium-lead alloy**. The results indicate that hydrogen dissoln. in liq. **lithium-lead alloy** has the characteristic of over-satn., and the measuring curves are non-linear. It is feasible to ext. hydrogen isotopes from liq. **lithium-lead alloy** by gas-liq. carrier. The influence of hydrogen partial pressure is much greater than that of **lithium-lead alloy** melting temp. on hydrogen soly. in liq. **lithium-lead alloy**.

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9. Hydrogen extraction from liquid **lithium-lead alloy** by gas-liquid contact method

By Xie, Bo; Weng, Kui-ping; Hou, Jian-ping; Yang, Guang-ling; Zeng, Jun
From [Hejubian Yu Dengliziti Wuli \(2013\)](#), 33(1), 83-87. Language: Chinese, Database: CAPLUS

Hydrogen extn. expt. from liq. **lithium-lead alloy** by gas-liq. contact method has been carried out in own liq. **lithium-lead** bubbler (LLLB). Exptl. results show that, He is more suitable than Ar as carrier gas in the filler tower. The higher temp. the tower is, the greater hydrogen content the tower exports. Influence of carrier gas flow rate on the hydrogen content in the export is jagged, no obvious rule. Although the difference between exptl. results and literature data, but it is feasible that hydrogen isotopes extn. expt. from liq. **lithium-lead** by gas-liq. contact method, and the higher extn. efficiency increases with the growth of the residence time of the **alloy** in tower.

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10. Probing materials for measurement of hydrogen in liquid **lithium-lead alloy**

By Xie, Bo; Wu, Yi-can; Hu, Sheng; Yang, Tong-zai
From [He Huaxue Yu Fangshe Huaxue \(2012\)](#), 34(3), 179-184. Language: Chinese, Database: CAPLUS

The dissoln. behavior of hydrogen isotopes in liq. **lithium-lead alloy** is an important ref. for the design of tritium extn. system in fusion reactor blanket. In order to solve the tech. problem of hydrogen content detn. in the liq. **lithium-lead alloy** and to develop the sensor for measuring hydrogen, a study for selection of a hydrogen-probing material among the candidates Al_2O_3 , SiC, $SiO_2-Cr_2O_3$ and TiC was carried out. The results show that SiC is the most appropriate choice as a probing material if only the measurement equil. time, **alloy** melting temp. and thermal shock are taken into account. It possesses the characters of high accuracy, high thermal stability, straightforward readout, good resistance to chem. corrosion, and repeated thermal shock. The Al_2O_3 and $SiO_2-Cr_2O_3$ are corrosion susceptible at high temp. **lithium-lead** environments. TiC tends to be oxidized at high temp., but its measuring value is more close to the theor. satn. value below 873 K measurement than SiC.

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11. Compatibility of erbium oxide coating with liquid lithium-lead alloy and corrosion protection effect of iron layer

By Chikada, Takumi; Suzuki, Akihiro; Terai, Takayuki; Muroga, Takeo; Koch, Freimut
From [Fusion Engineering and Design \(2013\)](#), 88(6-8), 640-643. Language: English, Database: CAPLUS,
DOI:10.1016/j.fusengdes.2013.03.075

Li-Pb compatibility of Er_2O_3 and Er_2O_3 -Fe two-layer coatings has been explored for an understanding of corrosion behaviors and effects of the protection layer. The coatings were peeled off after static Li-Pb immersion test at 600 °C due to the degrdn. of adhesion between the coating-substrate interface. A loss of Er and then subsequent corrosion of Er_2O_3 were shown after immersion at 500 °C for 500 and 1505 h. However, the outer Fe layer played a role to decrease corrosion rate of the coatings by comparing with the results of Er_2O_3 single layer coatings. Deuterium permeation measurements after corrosion tests at 500 °C showed that the Er_2O_3 coatings kept permeation redn. factors of 10^2 - 10^3 after 500 h immersion, but seriously degraded after 1505 h immersion. Corrosion mechanisms suggest that corrosion protection properties will be modified by an optimization of the outer Fe layer and a control of oxygen concn. in Li-Pb.

~3 Citings

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12. Two-dimensional numerical simulation of single bubble rising behavior in liquid metal using moving particle semi-implicit method

By Zuo, Juanli; Tian, Wenxi; Chen, Ronghua; Qiu, Suizheng; Su, Guanghui
From [Progress in Nuclear Energy \(2013\)](#), 64, 31-40. Language: English, Database: CAPLUS,
DOI:10.1016/j.pnucene.2012.12.003

Gas-lift pump in liq. metal cooling fast reactor (LMFR) is an innovative conceptual design to enhance the natural circulation ability of reactor core. The two phase flow characteristics of gas-liq. metal make significant improvement of the natural circulation capacity and reactor safety. It is important to study bubble flow in liq. metal. In present study, the rising behaviors of a single nitrogen bubble in 5 kinds of common stagnant liq. metals (lead bismuth alloy (LBE), liq. kalium (K), sodium (Na), potassium sodium alloy (Na-K) and lithium lead alloy (Li-Pb)) and in flowing lead bismuth alloy have been numerically simulated using two-dimensional moving particle semi-implicit (MPS) method. The whole bubble rising process in liq. was captured. The bubble shape, rising velocity and aspect ratio during rising process of single nitrogen bubble were studied. The computational results show that, in the stagnant liq. metals, the bubble rising shape can be described by the Grace's diagram, the terminal velocity is not beyond 0.3 m/s, the terminal aspect ratio is between 0.5 and 0.6. In the flowing lead bismuth alloy, as the liq. velocity increases, both the bubble aspect ratio and terminal velocity increase as well. This work is the fundamental research of two phase flow and will be important to the study of the natural circulation capability of Accelerator Driven System (ADS) by using gas-lift pump.

~2 Citings

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13. A fission-fusion hybrid reactor in steady-state L-mode tokamak configuration with natural uranium

By Reed, Mark; Parker, Ronald R.; Forget, Benoit
From [AIP Conference Proceedings \(2012\)](#), 1442(Fusion for Neutrons and Subcritical Nuclear Fission), 224-231.
Language: English, Database: CAPLUS, DOI:10.1063/1.4706872

A review. This work develops a conceptual design for a fusion-fission hybrid reactor operating in steady-state L-mode tokamak configuration with a subcrit. natural or depleted uranium pebble bed blanket. A liq. **lithium-lead alloy** breeds enough tritium to replenish that consumed by the D-T fusion reaction. The fission blanket augments the fusion power such that the fusion core itself need not have a high power gain, thus allowing for fully non-inductive (steady-state) low confinement mode (L-mode) operation at relatively small phys. dimensions. A neutron transport Monte Carlo code models the natural uranium fission blanket. Maximizing the fission power gain while breeding sufficient tritium allows for the selection of an optimal set of blanket parameters, which yields a max. prudent fission power gain of approx. 7. A 0-D tokamak model suffices to analyze approx. tokamak operating conditions. This fission blanket would allow the fusion component of a hybrid reactor with the same dimensions as ITER to operate in steady-state L-mode very comfortably with a fusion power gain of 6.7 and a thermal fusion power of 2.1 GW. Taking this further can det. the approx. min. scale for a steady-state L-mode tokamak hybrid reactor, which is a major radius of 5.2 m and an aspect ratio of 2.8. This min. scale device operates barely within the steady-state L-mode realm with a thermal fusion power of 1.7 GW. Basic thermal hydraulic anal. demonstrates that pressurized helium could cool the pebble bed fission blanket with a flow rate below 10 m/s. The Brayton cycle thermal efficiency is 41%. This reactor, dubbed the Steady-state L-mode non-Enriched Uranium Tokamak Hybrid (SLEUTH), with its very fast neutron spectrum, could be superior to pure fission reactors in terms of breeding fissile fuel and transmuting deleterious fission products. It would likely function best as a prolific plutonium breeder, and the plutonium it produces could actually be more proliferation-resistant than that bred by conventional fast reactors. Furthermore, it can maintain const. total hybrid power output as burnup proceeds by varying the neutron source strength. (c) 2012 American Institute of Physics.

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14. Numerical simulation on single bubble rising behavior in liquid metal using moving particle semi-implicit method

By Zuo, Juan-li; Tian, Wen-xi; Qiu, Sui-zheng; Chen, Rong-hua; Su, Guang-hui
From [Yuanzineng Kexue Jishu \(2011\), 45\(12\), 1449-1455](#). Language: Chinese, Database: CAPLUS

The gas-lift pump in liq. metal cooling fast reactor (LMFR) is an innovational conceptual design to enhance the natural circulation ability of reactor core. The two-phase flow character of gas-liq. metal makes significant improvement of the natural circulation capacity and reactor safety. In present basic study, the rising behavior of a single nitrogen bubble in five kinds of liq. metals (**lead bismuth alloy**, liq. kalium, sodium, potassium sodium **alloy** and **lithium lead alloy**) was numerically simulated using moving particle semi-implicit (MPS) method. The whole growing process of single nitrogen bubble in liq. metal was captured. The bubble shape and rising speed of single nitrogen bubble in each liq. metal were compared. The comparison between simulation results using MPS method and Grace graphical correlation shows a good agreement.

~1 Citing

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15. Towards the development of technical specifications for the production of **lithium-lead** alloys for the ITER HCLL TMB

By Barrado, Ana Isabel; Conde, Estefania; Fernandez, Marta; Gomez-Salazar, Jose Maria; Quejido, Alberto; Quinones, Javier
From [Fusion Engineering and Design \(2012\), 87\(7-8\), 1297-1300](#). Language: English, Database: CAPLUS, DOI:10.1016/j.fusengdes.2012.02.120

The ITER and DEMO projects are developing new Test Blanket Modules (TBM), where the Pb-Li **alloy** plays a key role in the new com. fusion reactors functionality. The Breeding Blanket (BB) has to perform several functions which are essential for the reactor operation. The HCLL TBM is one of the Breeding Blanket concepts to be tested in ITER. It is cooled by He and uses the eutectic liq. metal LLE (**Lithium-Lead Eutectic**) as breeder material (enriched at 90% in ⁶Li). Pb-Li eutectic **alloy** has no known uses outside of fusion technol., so the available databases of this material are currently incomplete. It is very important, within the material specifications, to have a complete characterization in order to define their chem. and phys. properties, because any variation in the **alloy** compn. has significant consequences in their behavior, and therefore in their regenerative function inside the blanket. The chem. characterization methodol. developed and presented in this paper (useful for both Pb-Li alloys as any Pb **alloy**) is a key tool that allows performing std. quality control procedures for base material and/or monitoring the **alloy** during the reactor operation. This report provides a procedure to perform a wide material chem. characterization, assessing the concns. of major elements, as well as a review of trace level elements that can be found both in the eutectic **alloy** and in starting materials. In this detn. plays an important role the ICP-MS technique because, as a highly sensitive technique, allows very low detection limits.

~2 Citings

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16. Gas-liquid exchange type bubbler for continuous extracting hydrogen isotope from liquid lithium-lead alloy

By Xie, Bo; Weng, Kuiping; Liu, Yunnu

From [Faming Zhuanli Shenqing \(2012\)](#), [CN 102358618 A 20120222](#), Language: Chinese, Database: CAPLUS

The title bubbler comprises a main loop system and an assistant system, wherein the main loop system comprises a Li-Pb satn. device, a filler column, a Li-Pb collector, a gas loop and a liq. flow path, and the flow path comprises a high-temp. pipeline, a high-temp. valve and a Li-Pb electromagnet pump. The assistant system comprises a temp. control instrument and a vacuum pump. The temp. control instrument links to the first heater, two heaters placed outside of the filler column and the third heater in the Li-Pb collector, and the vacuum pump links to the Li-Pb satn. device, a filler column and Li-Pb collector. The invention has remarkable extn. effect of hydrogen isotope, the device has good sealing property at high temp. and hardly blocks by impurities, and the soly. detection of hydrogen isotope in liq. Li-Pb is precise.

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17. Experimental study of tritium release from Li₁₇Pb₈₃ alloy

By Xie, Bo; Wu, Yi-can; Chen, Xiao-jun; Weng, Kui-ping; Liu, Jun; Xiao, Cheng-jian

From [Yuanzihe Wuli Pinglun \(2011\)](#), [28\(3\)](#), [371-376](#). Language: Chinese, Database: CAPLUS

Lithium-lead alloy is considered to be one of the most prominent tritium breeding materials for the fusion reactor blanket because of its high breeding ratio, and low reactivity and possible use as coolant. An out-of-pile expt. of tritium release from Li₁₇Pb₈₃ **alloy** was performed after neutron irradiation on the base of math. model to describe tritium release behavior from an eutectic **lithium-lead alloy**. The results suggest that the dominant chem. form of the released tritium (> 99%) was the water-insol. component (HT or T₂). Tritium residence time decreased with increasing H₂ pressure in carrier gas up to 1000 Pa, and above this concn. limit it became const. and not influenced by the plenum vol. The temp. dependence of the tritium release rate can be described by an Arrhenius law. Consequently, the present results on the kinetic parameters of tritium in molten Li₁₇Pb₈₃ **alloy** are considered to be different from the values in literature, but it is the same that the overall release process is governed by the diffusion of tritium atoms in the Li₁₇Pb₈₃ and by the heterogeneous reaction at the gas-eutectic interface of the tritium atom recombination at temps. from 633 to 973 K.

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18. Experimental system design of liquid lithium-lead alloy bubbler for DFLL-TBM

By Xie, Bo; Li, Jun-ge; Xu, Shao-mei; Weng, Kui-ping

From [Hejubian Yu Dengliziti Wuli \(2011\)](#), [31\(3\)](#), [283-288](#). Language: Chinese, Database: CAPLUS

The liq. **lithium-lead alloy** bubbler is a very important compn. in the tritium unit of Chinese Dual-Functional **Lithium Lead Test Blanket Module (DFLL-TBM)**. In order to complete the construction and run of the bubbler exptl. system, overall design of the system, main circuit design and auxiliary system design have been proposed on the basis of theor. calcns. for the interaction of hydrogen isotope with **lithium-lead alloy** and expt. for hydrogen extn. from liq. **lithium-lead alloy** by bubbling with rotational jet nozzle. The key of this design is gas-liq. exchange packed column, to achieve the measurement and extn. of hydrogen isotopes from liq. **lithium-lead alloy**.

~0 Citings

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19. Theoretical analysis of initial activation of lithium-lead alloy

By Xie, Bo; Gu, Mei; Xiao, Cheng-jian

From [Xiyou Jinshu Yu Yingzhi Hejin \(2011\)](#), [39\(2\)](#), [47-49](#), [53](#). Language: Chinese, Database: CAPLUS

The activation level and impurity control index were calcd. and analyzed initially based on irradiation dose rate. And the aim is to provide basic data for out-pile tritium release expt. from **lithium-lead alloy** and for the establishment of the personnel safety operation rule and regulation to ensure the abs. safety of irradiation expts. and tritium release expts. The results show that the dose rate of Li-Pb **alloy** is reduced up to the dose rate level requirement of radiochem. lab. operation, and the impurity control level is low under 15-h irradiation at the neutron dose rate of 1013 N/(cm² · s) and ¹⁰⁰Mo cooling and storage. However, the general chem. lab. operation requirement cannot be met even by ¹⁰⁰Mo storage.

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20. Experiments of hydrogen isotope permeation, diffusion and dissolution in Li-Pb

By Edao, Yuki; Noguchi, Hidetaka; Fukada, Satoshi

From *Journal of Nuclear Materials* (2011), 417(1-3), 723-726. Language: English, Database: CAPLUS, DOI:10.1016/j.jnucmat.2010.12.126

The permeability, diffusivity and soly. of hydrogen isotopes (H, D) in a Li-Pb eutectic alloy are measured in the temp. range from 573 to 973 K using a permeation method. Their isotope effects between H and D are obtained. It is shown that the soly. of hydrogen isotopes in Li-Pb obeys the Sieverts' law. The soly. of D is around 1.4 times larger than that of H. The isotope effect of the diffusivity between H and D is very small.

~13 Citings

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21. Chinese tritium technology of the liquid lithium-lead alloy experimental loop for ITER

By Xie, Bo; Wu, Yican; Weng, Kuiping; Yang, Tongzai; Liu, Yunnu; Song, Yong

From *Keji Daobao* (2011), 29(5), 69-73. Language: Chinese, Database: CAPLUS, DOI:10.3981/j.issn.1000-7857.2011.05.012

A review. The multinational cooperation in the International Thermonuclear Exptl. Reactor (ITER) plan aims to show that fusion reactors are a new and viable way to address global energy concerns. The Chinese Dual Function Lithium Lead Testing Blanket Module (DFLL-TBM) is one of the major research programs and uses liq. lithium-lead as both breeder and cooler, and a helium-hydrogen gas bubbling method is used to ext. tritium. So, tritium technol. is a key issue in the liq. metal blanket. Based on the development strategy for Chinese liq. lithium-lead exptl. blanket technol., development of Chinese tritium technol. for liq. lithium-lead loops between 2004 and 2010 was elaborated in three fields, namely, theor. anal. and calcn., exptl. research, and engineering design. Some important information was introduced, such as the simulation-design-develop of liq. lithium-lead bubbler, tritium anal. and permeation barriers in the loops, tritium release from lithium-lead after irradiation, design of tritium extn. system for the blanket, etc. These works indicate that it is possible to completely overcome the difficulties involving very small soly. of tritium in the lithium-lead, accumulation of magneto-hydro-dynamics (MHD) after a long period of continuous operation, materials corrosion together with the pressure drop caused by wall stress, and many tech. problems, such as tritium retention, penetration, recovery and environment pollution, can be thoroughly solved.

~1 Citing

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22. Hydrogen extraction from liquid lithium-lead alloy by bubbling with rotational jet nozzle

By Xie, Bo; Yang, Tong-zai; Guan, Rui; Weng, Kui-ping

From *Hejubian Yu Dengliziti Wuli* (2010), 30(2), 183-188. Language: Chinese, Database: CAPLUS

The technol. of tritium extn. from lithium-lead alloy has been simulated, and hydrogen extn. from lithium-lead alloy by bubbling with rotational jet nozzle being used to simulate tritium extn. is studied based on the introduction of fluid dynamics to establish algebraic model. The results show that the higher the lithium-lead melting temp., the higher cumulative hydrogen extn. efficiency, and gas holdup of bubble column is little affected by the impeller diam. Gas holdup when using small aperture is slightly higher than that when using large aperture only at a high helium flow rate, but the smaller the aperture, the greater the bubble surface area. And a marked increase in intensity of flow circulation for liq. lithium-lead is resulted with the increase of helium flow rate, and hydrogen extn. rate increases too. Moreover, influence of the jet rotational velocity on hydrogen extn. is limited.

~0 Citings

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23. Numerical simulation of bubble behavior in the Liquid Lithium Lead Bubbler

By Xie, Bo; Weng, Kuiping

From *Keji Daobao* (2010), 28(14), 44-48. Language: Chinese, Database: CAPLUS

The tritium fuel cycle of the liq. metal blanket is a core technol. for the normal operation of a fusion reactor or a fusion-fission hybrid reactor. The tritium fuel circulation system consists of the tritium purifn., the tritium extrn., the tritium storage, the tritium measurement, the helium/water cooling and the tritium recovery subsystem. The liq. metal bubbler located between the blanket main circuit and the tritium extrn. system is an indispensable key component for its important functions in tritium monitoring and removal. However, the development of a bubbler is difficult as the soly. of hydrogen isotopes in liq. **lithium lead** is very low and the liq. **alloy** has some unique characteristics in high temp., with respect to an effective design and building of a liq. **lithium lead** bubbler (LLLb) for the tritium breeding module (TBM) of fusion reactor. An algebraic model to describe the gas holdup characterization, the bubbler diam. and the size distribution is developed under the assumptions that the gas phase is non-Newtonian and there is no frictional force between gas and liq. phases. The simulation results showed that bubbles would break up much faster than while being coalesced under low gas velocity. In the LLLb, the breakage is a dominant feature for bubbles after they leave the orifice. Initial bubbles formed over the orifice are mostly larger than the largest stable bubble. They would break up quickly and their sizes are reduced to below the max. diam. (d) of stable bubbles. Moreover, the gas-liq. surface area would be increased even though the gas holdup does not change significantly. A high mass transfer area could be obtained by injecting more small initial bubbles with diams. under d_g .

~0 Citings

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24. Theoretical study of tritium diffusion behavior in **lithium-lead alloy**

By Xie, Bo; Weng, Kui-ping

From [Fenzi Kexue Xuebao \(2009\), 25\(5\), 352-356](#). Language: Chinese, Database: CAPLUS

Lithium-lead alloy is very promising prodn. tritium materials for the blanket of fusion reactor, fusion-fission hybrid reactor. It is important to study the tritium spread behavior in **lithium-lead alloy**. In this paper, the flat-panel model to describe the tritium diffusion in **lithium-lead** system has been built based on the spread of the hydrogen in the metal by macro-laws. According to the relevant literature data, diffusion behavior of tritium has been carried under different approach, tritium concn., temp. to explore the micro-mechanism of this proliferation. The results show that the large differences between the conclusions due to the **lithium-lead** surface phys. and chem. state of the different considerations and in a certain temp. range, the higher the concn. of tritium diffusion coeff. caused by the drop and higher temp. causing the diffusion coeff. higher.

~1 Citing

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25. Study of surficial corrosion of 304L stainless steel in liquid **LiPb alloy**

By Xie, Bo; Hu, Rui; Weng, Kuiping

From [Sichuan Huagong \(2009\), 12\(1\), 30-32](#). Language: Chinese, Database: CAPLUS

The surficial corrosion behavior of 304L stainless steel in liq. **LiPb alloy** is studied by hang flake method and corrosion wt. loss and SEM anal. The result shows that main reason of materials corrosion is dissoln. and quality-migration of elemental compn. in liq. **LiPb alloy**, and the most important factors of influence surficial corrosion are temp. and oxygen compn. in **alloy**.

~0 Citings

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26. Industrial **lithium-lead alloy** for nuclear reactor

By Huang, Qunying; Chen, Yaping; Gao, Sheng; Zhu, Zhiqiang; Wu, Yican

From [Faming Zhuanli Shenqing Gongkai Shuomingshu \(2009\), CN 101440446 A 20090527](#), Language: Chinese, Database: CAPLUS

The **alloy** comprises $0.68 \pm 0.01\%$ Li and bal. of Pb.

~0 Citings

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27. Method for preparing Li-Pb alloys for nuclear fusion reactor by adopting online temperature detection, electromagnetic stirring, argon atmosphere melting and vacuum casting for obviating macrosegregation and high-melting-point compound generation and realizing easy control of local temperature and **lithium** content

By Gao, Sheng; Huang, Qunying; Chen, Yaping; Zhu, Zhiqiang; Wu, Yican
From [Faming Zhuanli Shenqing \(2009\), CN 101440437 A 20090527](#), Language: Chinese, Database: CAPLUS

The invention relates to a prepn. method of Li-Pb alloys for nuclear fusion reactor. It comprises placing Pb into an alumina crucible, introducing high-purity hydrogen gas, heating to 500-700°C, keeping for 6-10 h, placing the pretreated Pb in a Mo crucible and putting the crucible into a melting furnace, vacuumizing the furnace to 0.1-1 Pa, introducing 0.08-0.1 MPa high-purity argon gas, heating Pb in the furnace to 400-450°C, keeping for 30-40 min, batch adding Li into the molten Pb under electromagnetic stirring while controlling melt temp. not higher than 600°C, keeping stirring for 10-20 min after Li addn. is finished, standing at 550-600°C for 2-4 h, repeating the Li addn. till the contents of Li and Pb, which are obtained via online detection, are qualified, and vacuum-casting at 280-350°C. The invention obviates macrosegregation and high-melting-point compd. generation and realizes easy control of local temp. and **lithium** content.

~0 Citings

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28. Behavior of tritium release from liquid LiPb alloy

By Xie, Bo; Hu, Rui
From [Hedongli Gongcheng \(2009\), 30\(1\), 124-128](#). Language: Chinese, Database: CAPLUS

Liq. **lithium lead alloy** is a prominent breeder material for the fusion reactor tritium blanket. For an effective calcn. of the knowledge of kinetics of tritium release behavior from liq. LiPb **alloy**, a math. model is built by taking into consideration the theory of metals and hydrogen and the design of the bubble tritium extn. system from the liq. **lithium-lead** module for fusion reactor. The calcn. data of tritium release-behavior from liq. LiPb under different operating conditions of temp. and tritium partial pressures and helium gas flow-rates and mass transfer coeffs. are obtained. These results have shown that the overall release process, even though including five sub-processes (transport of the tritium by diffusion and convection, transport of the tritium by diffusion through a layer of eutectic adjacent to the gas-eutectic interface, heterogeneous reaction at the interface of the tritium atoms recombination, diffusion of the tritium through the gas-phase boundary layer, and transport of the gaseous tritium by diffusion and convection from the gas phase boundary layer), is governed by the diffusion of tritium atoms in the LiPb and by the heterogeneous reaction at the gas-eutectic interface of the tritium atoms recombination in the desorption temp. vary from 633 to 723 K.

~1 Citing

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29. Static corrosion behaviour of 316L stainless steel in liquid LiPb alloy

By Xie, Bo; Wang, Heyi; Weng, Kuiping
From [Hejishu \(2008\), 31\(2\), 90-94](#). Language: Chinese, Database: CAPLUS

Static corrosion behavior of 316L stainless steel in liq. LiPb **alloy** was studied by hang-flake method and corrosion wt. loss and metal-phase anal. The results showed that main reason of materials corrosion was dissoln. and quality-migration of elemental compn. in liq. LiPb **alloy**, and the most important factor of influence corrosion behavior was temp. and oxygen compn. in the **alloy** or other materials.

~0 Citings

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30. Primary design of a tritium extraction system of the liquid lithium-lead blanket for the fusion-fission hybrid reactor

By Xie, Bo; Hu, Rui; Liu, Yunnu
From [Keji Daobao \(2008\), 26\(23\), 23-26](#). Language: Chinese, Database: CAPLUS

A review. The liq. **lithium lead alloy** is a prominent breeder material for the fusion-fission hybrid reactor tritium blanket. The tritium extn. system of the liq. **lithium-lead** blanket is one of the most important ancillary units in fusion-fission hybrid reactor. In this design, in order to realize the deuterium-tritium fuel circulation, the main function of the liq. **lithium-lead** blanket-tritium extn. system is to ext. tritium produced in liq. LiPb blanket by purge gas, to control the gas compn. of the low pressure purge flow and to provide tritium-breeding data of liq. LiPb loop by measuring and monitoring the operation parameters of the system (temp., pressure, gas components, gas flow rates, tritium concn., etc.), and to test the reliability of tritium extn. system. This paper reviews the state-of-the-art of the tritium related technol. from the initial tritium prodn. in the LiPb breeder material to a tritium stream which is ready for re-injection into the plasma with 7 refs. The development issues are outlined and conventional techniques are compared with advanced methods which require more research and development effort but promise the advantages in return. System parameters, flow process, anal. instrument and ancillary installations are discussed in detail.

~1 Citing

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31. Corrosion behavior of pure Fe and 316L stainless steel in liquid LiPb alloy

By Xie, Bo; Wang, He-yi; Weng, Kui-ping; Liu, Yun-nu; Guan, Rui; Hou, Jian-ping
From [He Huaxue Yu Fangshe Huaxue \(2008\)](#), 30(1), 23-28. Language: Chinese, Database: CAPLUS

The stationary corrosion behavior of high-purity Fe and 316L stainless steel in liq. LiPb alloy at 350-550°C was studied by rotating hang specimens method and corrosion wt. loss and metallog. anal. The results show that main reasons of materials corrosion are temp., dissoln., and mass-transfer of compn. elements in liq. LiPb alloy. The oxygen scale on the surface of materials is also one of the important factors.

~0 Citings

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32. On the more efficient trace tritium recovery from the residue of liquid Li-Pb alloy

By Xie, Bo; Liu, Yunnu; Weng, Kuiping
From [Anquan Yu Huanjing Xuebao \(2008\)](#), 8(1), 69-72. Language: Chinese, Database: CAPLUS

The present paper is aimed at introducing our study on how to reduce the loss of tritium effectively and to minimize the radioactive exposure in the process of trace tritium recovery from the residue of liq. Li-Pb alloy. For this purpose, we have investigated the isotope exchange process for the trace recovery from the imitative residue of the alloy. Our study results indicate that the isotope exchange system we have developed is an effective way for such recovery practice with the best component of exchange carrier gas being He+0.1% D₂ and the optimal exchange temps. and exchange data being the main influential factors to the recovery efficiency. As the actual process shows, the trace tritium recovery efficiency is likely to increase with the rising of the exchange temp. and exchange amt. The highest tritium recovery efficiency can be made to reach 80% with the residue treated for 6 times at 823 K. In addn., we have also worked out a dynamic math. model for liq. metal recovery in the medium of gaseous atm. and the approx. math. equation of tritium residue in Li-Pb alloy on the basis of our expts. Theor. anal. of these data shows that the overall desorption process is likely to be governed by the diffusion of tritium atoms in the Li-Pb and by the heterogeneous reaction at the gas-eutectic interface of the tritium atoms recombination. For the time being, it remains impossible to deduce any kinetic parameters, such as the diffusion coeff. of tritium and the reaction rate of tritium on the alloy surface, such as the diffusion coeff. of tritium and the reaction rate of tritium on the alloy surface, for the tritium residence time involves a few other processes. Further investigations are needed to test the variables of the amt. and surface area of the sample may involve.

~1 Citing

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33. Corrosion behavior of clam in liquid alloy at 480°C

By Zhang, M.; Huang, Q.; Wu, Y.; Zhu, Z.; Gao, S.; Song, Y.; Li, C.
From [Materials Science Forum \(2007\)](#), 561-565(Pt. 3, PRICM 6), 1741-1744. Language: English, Database: CAPLUS, DOI:10.4028/www.scientific.net/MSF.561-565.1741

China Low Activation Martensitic steel (CLAM), which is one of the RAFMs (Reduced Activation Ferritic/Martensitic steels) and under development in ASIPP, is considered as the primary candidate structural material and LiPb eutectic as both tritium breeder and coolant of the blankets in FDS series fusion reactors. The corrosion behavior of CLAM steel exposed to the liq. breeder LiPb is of significance. Corrosion tests of CLAM in flowing LiPb at 480° were performed up to about 2000 h to analyze the corrosion mechanism of CLAM exposed to liq. LiPb. The specimens were obsd. and analyzed by SEM and Energy Dispersive X-ray Spectroscopy (EDX) after 500 h, 1000 h, and 2000 h corrosion expt. resp. The corrosion is of non-uniform and the wt. loss was about 0.23 mg/cm² after 2000 h' exposure, which is smaller for CLAM compared to those of other RAFMs.

~7 Citings

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34. Fundamental study on purity control of the liquid metal blanket using solid electrolyte cell

By Yamamoto, Yoshihiko; Yamanishi, Toshihiko; Kawamura, Yoshinori; Isobe, Kanetsugu; Yamamoto, Yasushi; Konishi, Satoshi
From [Fusion Science and Technology \(2007\)](#), 52(3), 692-695. Language: English, Database: CAPLUS

Liq. LiPb blanket system is investigated in the fusion reactor. This study's purpose is the purity control of the oxygen and hydrogen in LiPb using solid electrolyte cell. This system has the advantages such as capability of continuous monitoring without sampling. The cell made of YSZ solid electrolyte was used for measuring partial oxygen potential in the range 400-450 degree C. Measured emf of the cell in LiPb is converted to oxygen activity with Nernst equation. And calcd. oxygen activity in LiPb from thermodyn. theory agrees with obsd. value. The result of expt. shows the feasibility of the solid electrolyte cell.

~2 Citings

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35. Wetting of W by liquid Pb and PbLi alloys and surface interactions

By Protsenko, Pavel; Terlain, Anne; Eustathopoulos, Nicolas
From [Journal of Nuclear Materials](#) (2007), 360(3), 265-271. Language: English, Database: CAPLUS,
DOI:10.1016/j.jnucmat.2006.10.005

Wetting of W by Pb and Pb-17 at.%Li in the range 400-900° was studied by the dispensed drop technique. Expts. were performed using different furnace atmospheres (high vacuum, reducing gas) and different heat treatments to achieve W deoxidn. A simple pairwise model was used to explain the relation between surface interaction, which is responsible for wetting, and bulk interactions detg. miscibility.

~4 Citings

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36. Relationship between the structural parameters of Li₁₇Pb₈₃ melt and its interaction with stainless steels

By Duryagina, Z. A.; Mudryi, S. I.; Lutsyshyn, T. I.
From [Materials Science \(New York, NY, United States\)\(Translation of Fiziko-Khimichna Mekhanika Materialiv\)](#) (2004), 40(1), 94-101. Language: English, Database: CAPLUS, DOI:10.1023/B:MASC.0000042791.09470.8c

The existing correlation between the data of x-ray diffraction anal. and the numerical results obtained on the basis of the model of hard spheres enables to predict the variations of surface tension and evaluate the wettability of steel according to the shifts of the extrema of a continuous function of the structural factor of a melt. The influence of elements (Nb, Zr, and Si+B) laser-doped into the surface of stainless steels on the structural factors of Pb and Li₁₇Pb₈₃ melts is also analyzed.

~0 Citings

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37. Water large leaks into liquid Pb-17Li: first experimental results on LIFUS 5 facility

By Ciampichetti, A.; Ricapito, I.; Aiello, A.; Benamati, G.
From [Fusion Engineering and Design](#) (2003), 69(1-4), 563-567. Language: English, Database: CAPLUS,
DOI:10.1016/S0920-3796(03)00135-2

Since several years ENEA is involved in exptl. activities concerning the interaction between molten **lithium lead alloy**, in eutectic compn., and pressurized water in conditions relevant for DEMO fusion reactor, in order to predict the behavior of a WCLL blanket module in case of an in blanket LOCA. In this ambit LIFUS 5 app. was designed and constructed to carry out the exptl. campaign on water large leaks into liq. Pb-17Li, with the final aim to provide data for the validation of the math. modeling of the related phenomena. After two tests performed to qualify all mech. components and the data acquisition system, LIFUS 5 was operated at the ENEA C.R. Brasimone for tests nos. 3 and 4. Water was injected into the reaction tank at a pressure of 155 bar with two different values of sub-cooling. The initial liq. metal temp. was fixed to 330°C. The first pressure peak due to the water vaporization and jet expansion was clearly recognized together with the subsequent pressure increase due to further water injection and hydrogen generation. In the performed expts. the max. pressure peak, as detected in both reaction and expansion vessels, never overcame the value of the injected water. Moreover, in these two tests a significant temp. increase in the reaction vessel occurred, strictly connected to the amt. of injected water.

~11 Citings

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38. MHD free convection in a liquid-metal filled cubic enclosure. II. Internal heating

By Di Piazza, Ivan; Ciofalo, Michele

From [International Journal of Heat and Mass Transfer \(2002\), 45\(7\), 1493-1511](#). Language: English, Database: CAPLUS, DOI:10.1016/S0017-9310(01)00253-8

The buoyancy-driven MHD flow in a liq.-metal filled cubic enclosure with internal heat generation was investigated by 3-dimensional numerical simulation. The enclosure was volumetrically heated by a uniform power d . and was cooled along two opposite vertical walls, all other walls being adiabatic. A uniform magnetic field was applied orthogonally to the gravity vector and to the temp. gradient (i.e., parallel to the isothermal walls). The Prandtl no. was 0.0321 (characteristic of Pb-17Li at 573 K); the Rayleigh no. was made to vary from 10^5 to 10^7 , the Hartmann no. between 10^2 and 10^3 and the elec. conductance of the walls between 0 and infinity. The Navier-Stokes equations, in conjunction with a scalar transport equation for the fluid's enthalpy and with the Poisson equation for the elec. potential, were solved by a finite vol. method using the CFD package CFX-4 with some necessary adaptations. Steady-state conditions were assumed. In all cases, a three-dimensional flow with complex secondary motions and a complex current pattern was established. The effects of Hartmann no., wall conductance ratio and Rayleigh no. were discussed and results were compared with those previously obtained for fully developed flow in an infinitely tall, internally heated channel of square cross-section. The related case of a differentially heated cubic enclosure is discussed in a companion paper.

~7 Citings

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39. MHD free convection in a liquid-metal filled cubic enclosure. I. Differential heating

By Di Piazza, Ivan; Ciofalo, Michele

From [International Journal of Heat and Mass Transfer \(2002\), 45\(7\), 1477-1492](#). Language: English, Database: CAPLUS, DOI:10.1016/S0017-9310(01)00252-6

The buoyancy-driven MHD flow in a liq.-metal filled cubic enclosure was investigated by three-dimensional numerical simulation. The enclosure was differentially heated at two opposite vertical walls, all other walls being adiabatic, and a uniform magnetic field was applied orthogonal to the temp. gradient and to the gravity vector. The Rayleigh no. was 10^5 and the Prandtl no. was 0.0321 (characteristic for fusion reactor breeding blankets of Pb-17Li at 573 K). The Hartmann no. was made to vary between 10^2 and 10^3 and the elec. conductance of the walls between 0 and ∞ . The continuity, momentum and enthalpy transport equations, in conjunction with a Poisson equation for the elec. potential, were solved by a finite vol. method using the general-purpose CFX-4 package with some necessary adaptations. Steady-state conditions were assumed. With respect to the case of parallel flow in an infinitely tall enclosure, studied in previous work, the suppression of convective motions due to MHD interactions was stronger in the core, and a complex three-dimensional flow (with secondary motions) and current pattern was established in the fluid domain. Increasing the Hartmann no. suppressed convective motions and exalted the square-shape of the circulation cells. Increasing the wall conductance ratio from perfectly insulating to perfectly conducting walls also resulted in an increasing suppression of convection. The related case of an internally heated enclosure is discussed in a companion paper.

~7 Citings

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40. Thermodynamic study of liquid lithium-lead alloys using the EMF method

By Gasior, W.; Moser, Z.

From [Journal of Nuclear Materials \(2001\), 294\(1,2\), 77-83](#). Language: English, Database: CAPLUS, DOI:10.1016/S0022-3115(01)00440-8

Liq. Li-Pb alloys were investigated by the emf. (emf) method at Li concns. of $0.025 \leq X_{Li} \leq 0.965$ mol fraction and at temps. from 775 to 975 K. The expts. were conducted at const. temp., and the Li concn. was changed by the coulometric-titrn. technique. The two-phase Li-Bi alloys and liq. lithium were used as the ref. electrodes. The dependence of emfs on temp. for each investigated alloy was linear, and from the linear equations ($E = a + bT$), partial Li excess Gibbs energies, partial enthalpies and entropies of lithium were calcd., and compared with previously published data. The excess stability function ES and the concn.-concn. partial structure factor $S_{cc}(0)$ were calcd. and discussed in relation to the neutron diffraction data and other properties. A change in the type of chem. bonding near the compn. Li_4Pb is indicated. This study was initiated since Pb-17Li eutectic alloy was proposed as a breeder blanket fluid for fusion reactors.

~8 Citings

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41. Magnetohydrodynamic heat transfer research related to the design of fusion blankets

By Barleon, Leopold; Burr, Ulrich; Mack, Klaus Jurgen; Stieglitz, Robert

From [Fusion Technology \(2001\), 39\(2\), 127-156](#). Language: English, Database: CAPLUS

A review with 55 refs. concerning MHD heat transfer research related to the design of fusion blankets is presented. **Lithium** or any **lithium alloy** like the **lithium lead alloy** Pb-17Li is an attractive breeder material used in blankets of fusion power reactors because it allows the breeding of tritium and, in the case of self-cooled blankets, the transfer of the heat generated within the liq. metal and the walls of the cooling ducts to an external heat exchanger. Nevertheless, this type of liq.-metal-cooled blanket, called a self-cooled blanket, requires specific design of the coolant ducts, because the interaction of the circulating fluid and the plasma-confining magnetic fields causes MHD (MHD) effects, yielding completely different flow patterns compared to ordinary hydrodynamics (OHD) and pressure drops significantly higher than there. In contrast to OHD, MHD flows depend strongly on the elec. properties of the wall. Also, MHD flows reveal anisotropic turbulence behavior and are quite sensitive to obstacles exposed to the fluid flow. A comprehensive study of the heat transfer characteristics of free and forced convective MHD flows at fusion-relevant conditions is conducted. The general ideas of the anal. and numerical models to describe MHD heat transfer phenomena in this parameter regime are discussed. The MHD lab. being installed, the exptl. program established, and the expts. on heat transfer of free and forced convective flow being conducted are described. The theor. results are compared to the results of a series of expts. in forced and free convective MHD flows with different wall properties, such as elec. insulating as well as elec. conducting ducts. Based on this knowledge, methods to improve the heat transfer by means of electromagnetic/mechanic turbulence promoters (TPs) or sophisticated, arranged elec. conducting walls are discussed, exptl. results are shown, and a cost-benefit anal. related to these methods is performed. Nevertheless, a few exptl. results obtained should be highlighted: 1. The heat flux removable in rectangular elec. conducting ducts at walls parallel to the magnetic field is by a factor of 2 higher than in the slug flow model previously used in design calcns. Conditions for which this heat transfer enhancement is attainable are presented. The measured dimensionless pressure gradient coincides with the theor. one and is const. throughout the whole Reynolds no. regime investigated ($Re = 10^3 \rightarrow 10^5$), although the flow turns from laminar to turbulent. The use of electromagnetic TPs close to the heated wall leads to nonmeasurable increase of the heat transfer in the same Re regime as long as they do not **lead** to an interaction with the wall adjacent boundary layers. 2. Mech. TPs used in an elec. insulated rectangular duct improved the heat transfer up to seven times compared to slug flow, but the pressure drop can increase also up to 300%. In a cost-benefit anal., the advantageous parameter regime for applying this method is detd.

~3 Citings

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42. Modelling of the Pb17Li/water interaction within a blanket module

By Sardain, P.; Benamati, G.; Ricapito, I.; Marbach, G.

From [Fusion Engineering and Design \(2000\), 51-52\(Proceedings of the Fifth International Symposium on Fusion Nuclear Technology, 1999, Part B\), 611-616](#). Language: English, Database: CAPLUS, DOI:10.1016/S0920-3796(00)00252-0

In the frame of the WCLL (water cooled **lithium lead**) program, exptl. and theor. activities are devoted to study the interaction between the cooling water and **lithium lead alloy**. In case of large leakage, the interaction can **lead** to a pressurization of a blanket module which can challenge its integrity. Therefore, it is important to assess its consequences as accurately as possible. In order to make possible the modeling of the next LIFUS 5 exptl. activity and to correctly understand the phenomena connected to a large break LOCA (loss of coolant accident) in the breeder zone in real conditions, a math. model has been tested on the BLAST experiences carried out at JRC-Ispra in the past years. A good fitting between exptl. and modeling results has been obtained as shown in this paper.

~0 Citings

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43. The ionic structure and the electronic states of liquid Li-Pb alloys obtained from ab initio molecular dynamics simulations

By Senda, Y.; Shimojo, F.; Hoshino, K.

From [Journal of Physics: Condensed Matter \(2000\), 12\(28\), 6101-6112](#). Language: English, Database: CAPLUS, DOI:10.1088/0953-8984/12/28/307

Ab initio mol. dynamics simulations are carried out for liq. $Li_{0.8}Pb_{0.2}$ and $Li_{0.5}Pb_{0.5}$ alloys to investigate the ionic structure and the electronic states. In our simulation, the existence of the "chem. complex" Li_4Pb is not found; rather, a salt-like ordering of Pb ions is seen in the liq. $Li_{0.8}Pb_{0.2}$ alloy. It is found from the calcd. partial and total structure factors that this ordering leads to the characteristic behavior of the total structure factor, which agrees well with the results of a neutron diffraction expt. The compn. dependence of the electronic states is explained on the basis of the ionic configuration. The tendency towards ionicity or charge transfer is seen in both liq. alloys, though the valence-electronic charge distribution is not so localized around the ions.

~7 Citings

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44. Electrical resistivity of alkali-lead binary alloys

By Khajil, T.

From [Physics and Chemistry of Liquids \(1999\)](#), 37(6), 773-784. Language: English, Database: CAPLUS, DOI:10.1080/00319109908035955

The elec. resistivity of liq. Li-Pb, Pb-K and Pb-Na binary alloys as a function of composition was calcd. using Faber-Ziman formalism modified for finite mean free-path. The partial structure factors described by hard sphere model of Ashcroft and Langreth were used in the calcns. The nonlocal pseudopotentials of Heine-Abarenkov were used also. The calcd. resistivity values are in reasonably good agreement with the expt.

~10 Citings

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45. The behavior of molten Pb and 83 a/o Pb-17 a/o Li when impacted by a vertical column of water

By Nelson, Lloyd S.; Farahani, Ali; Krueger, Joseph D.; Corradini, Michael L.

From [Proceedings of the International Topical Meeting on Advanced Reactors Safety, 2nd, Orlando, Fla., June 1-5, 1997 \(1997\)](#), 1, 487-495. Language: English, Database: CAPLUS

Because water-cooled molten Pb-17 a/o Li eutectic is being considered as a breeder/blanket for nuclear fusion, we must understand the interactions that occur if this alloy inadvertently contacts liq. water. We have, therefore, compared the behavior of 120 g of the molten alloy with that of 140 g of molten lead, both at 600°C when impacted with a vertical 2.4 m-tall column of water at 25°C or 60°C. (Temps. and wts. are nominal.). The intent of this study was to det. differences between the fuel-coolant interaction (FCI) behaviors of a chem. reactive melt, the PbLi alloy, and of an inert material, Pb. H₂ and aq. solns. of LiOH, both potentially hazardous, were generated with the alloy, but not with the Pb. Although significant chem. reaction occurred with the alloy, no augmentation of the energetics was measured nor was there any indication of runaway metal ignition. The observations can be interpreted as the typical FCI phenomena seen in shock tube geometry, i.e., hydrodynamic forced mixing of melt by water column impact driving thermal interaction at the melt-water interface. Chem. reactions seem to follow this melt-water contact, moderating, not augmenting, the energetics.

~0 Citings

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46. On the influence of a high magnetic field on the corrosion and deposition processes in the liquid Pb-17Li alloy

By Barbier, F.; Alemany, A.; Martemianov, S.

From [Fusion Engineering and Design \(1998\)](#), 43(2), 199-208. Language: English, Database: CAPLUS, DOI:10.1016/S0920-3796(98)00420-7

In the water-cooled blanket concept designed for fusion reactors, the liq. Pb-17Li alloy surrounding the water pipes is used to produce the tritium required for a self-sustaining fusion reaction. During operation, the steel box which acts as the liq. metal container can be corroded by the lithium-lead alloy flowing at low velocity. The corrosion products dissolved in the alloy are then transported with the flow. In some regions, characterized for example by low temps., these corrosion products can crystallize and form aggregates which can be deposited on the wall and can contribute to the plugging of the ducts. The mechanisms involved in corrosion, formation of aggregates and deposition depend on several factors such as hydrodynamics, soly., kinetics of exchange at the solid/liq. interface, roughness of the wall, ... in addn., they can also be affected by the high external magnetic field used to confine the plasma. The present paper gives an overview of the different types of possible magnetic field effects on the corrosion and deposition processes in the flowing liq. alloy. A review with 33 refs.

~6 Citings

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47. Compatibility of ceramic coating materials with liquid tritium breeder for fusion blankets

By Mitsuyama, Takaaki; Yoneoka, Toshiaki; Terai, Takayuki; Tanaka, Satoru

From [Sogo Shikensho Nenpo \(Tokyo Daigaku Kogakubu\) \(1997\)](#), 56, 157-162. Language: Japanese, Database: CAPLUS

Development of a ceramic coating is one of the most important subjects in liq. blanket research and development. The compatibility of candidate oxide ceramic materials (Y_2O_3 , Al_2O_3 , MgO and $3Al_2O_3-MgO$) with liq. metal breeders such as metallic Li and Li17-Pb83 alloy was investigated at 773 K up to 1400 h with the change in insulating property. The Al_2O_3 and $3AlO_3-MgO$ were severely corroded and dissolved or broken by Li, while MgO was corroded uniformly at a moderate rate (e.g. 27 μm for 1325 h). The most thermodynamically stable Y_2O_3 was little corroded and showed a slight increase in elec. cond. On the other hand, none of the ceramic materials were corroded at all by Li17-Pb83, as predicted by a thermodyn. anal.

~0 Citings

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48. Tritium recovery from Li17-Pb83 liquid breeder by permeation window method

By Terai, T.; Suzuki, A.; Tanaka, S.

Edited By: Varandas, C.; Serra, F

From [Fusion Technology 1996, Proceedings of the Symposium on Fusion Technology, 19th, Lisbon, Sept. 16-20, 1996 \(1997\), 2, 1229-1232](#). Language: English, Database: CAPLUS

The T permeation window method was demonstrated by out-pile D permeation expts. The D permeation rate was measured by changing the parameters, such as the chem. compn. of the purge gas, the fluidity of the Li17-Pb83, the temp., and the condition of the surface oxide film to clarify the rate-detg. process. The overall mass-transfer coeff. of D from Li17-Pb83 to purge gas through the Nb wall was smaller by 2-5 orders of magnitude than that detd. by D diffusion in Nb. This behavior is not due to D diffusion in the Li17-Pb83 liq. film but to the formation of Nb oxides on the surface as a permeation barrier. The permeation rate severely decreased with the growth of the surface oxide film, and it became too small for an actual blanket system. Therefore, it is necessary to protect the Nb surface from oxidn. or to use a more noble metal than Nb.

~0 Citings

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49. Continuous monitoring and adjustment of the lithium content in liquid Pb-Li alloys: assessment of an electrical resistivity meter in a loop system

By Barbier, F.

From [Fusion Engineering and Design \(1997\), 36\(2-3\), 299-308](#). Language: English, Database: CAPLUS, DOI:10.1016/S0920-3796(96)00697-7

The operation of an elec. resistivity meter to detect changes in the lithium content of liq. Pb-Li alloys has been assessed in a loop system. Initially, the response of the monitor to ingress of oxygen was tested. The reaction of oxygen with flowing Pb-Li alloys was detected by the app. and the decrease in lithium content was found to be in agreement with Li_2O formation. Subsequently, the adjustment of the lithium concn. was performed by the addn. of LiPb. These compds. were easily prepd. by mixing lead and lithium in equimolar proportions from the liq. state. The ingots produced after solidification of the mixt. were then immersed in the alloy of the loop and were entirely dissolved within a short period. The resistivity meter responded very well after each LiPb addn. and a steady increase in lithium content was obsd. The monitor was sensitive to compn. changes of ± 0.15 at.% Li. Its response time was limited only by the rate of sampling and mixing in the loop.

~6 Citings

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50. Metal tritium-breeder materials for ITER [fusion-reactor] blanket

By Tebus, V. N.; Petrov, B. V.; Romanov, P. V.; Klabukov, Yu. G.; Aksenov, B. S.; Shipilov, V. V.

From [Atomnaya Energiya \(1996\), 81\(5\), 372-378](#). Language: Russian, Database: CAPLUS

Thermonuclear reactor design was considered with the core blanketed with eutectic $Li_{17}Pb_{83}$ alloy to promote simplified recovery of radiogenic T and He by melt-flow degassing of the blanket segments. The melt degassing is typically at 700 K for effective removal of the T at 1 ppm, and its concn. to ~ 100 ppm as T_2 in the He-contg. gas phase. Design of the degassing app. was examd., including the removal of radionuclide wastes (esp. ^{210}Po). The Li-Pb eutectic alloy for core blanketing can be prepd. in MORELIS column app. using molten metals with compensation for the loss of reacted Li.

~1 Citing

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51. Recovery of tritium from liquid blanket of lithium, Li-Pb eutectic alloy or molten salt

By Fukada, Satoshi; Nishikawa, Masabumi

From [Toyama Daigaku Suiso Doitai Kino Kenkyu Senta Kenkyu Hokoku \(1994\)](#), 14, 1-21. Language: Japanese, Database: CAPLUS

Several methods for T recovery from liq. Li, Li-Pb eutectic alloy, aq. salt soln. or fluoride salt (Flibe) of the breeding materials of a fusion reactor were comparatively studied based on engineering designs. The methods of a permeation window, an Y particle bed and molten salt extn. were promising for liq. Li. The methods of a permeation window, counter-current extn. in a packed bed and cold trapping in a Na or NaK loop were hopeful for T recovery from Li₁₇Pb₈₃ eutectic. The methods of He gas purging and vacuum extn. were successfully applied to the Flibe blanket. Impurity effects and various interactions in the T recovery systems need to be studied.

~3 Citings

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52. Improved grid alloy for lead-acid battery

By Dou, Shi Xue; Chen, You Xiao; Luan, Ben Li; Zhao, Hui Jun; Liu, Hua Kun

From [PCT Int. Appl. \(1995\)](#), WO 9515587 A1 19950608, Language: English, Database: CAPLUS

A grid alloy for use esp., but not exclusively, in sealed, maintenance-free Pb-acid batteries includes a component or components which preferably improve mech. strength of the grid and/or prevent or at least decrease the formation of PbSO₄ a corrosion product and/or which improves the surface state of the grid material and/or which inhibit the deposition of various metals on cryst. boundaries of the alloy. The grid alloy can include group 1A and/or Group 5A metallic elements and/or Ag, esp. As and/or Bi, K and/or Na and optionally Ca and/or Li, Sn and/or Cu, Al and/or Mg and/or Zn.

~1 Citing

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53. Decrease of deuterium permeation rate through austenitic stainless steel facing molten Li17-Pb83 alloy with formation of surface oxide film

By Terai, Takayuki; Uozumi, Kouichi; Yoneoka, Toshiaki

From [Journal of Nuclear Science and Technology \(1994\)](#), 31(6), 617-19. Language: English, Database: CAPLUS, DOI:10.1080/18811248.1994.9735197

To consider quant. the possibility of oxide films as a tritium permeation barrier for Li17-Pb83 blanket design, the permeability change of H isotopes should be clarified in connection with the characteristics of the oxide film. From this point of view, by an out-pile expt., a study was made of deuterium permeation through type 316 austenitic stainless steel (SUS 316) facing molten Li17-Pb83 alloy under controlled conditions of temp. and purge gas chem., while analyzing the surface oxide film before and after the expt. by x-ray diffractometry (XRD) and Auger electron spectroscopy (AES). As the first step, the authors report the decrease of deuterium permeation rate at 600° for 40 days under a stream of Ar contg. hydrogen isotope and a trace of water vapor, and the formation of oxide film contg. Cr₂O₃ and FeCr₂O₄ with a thickness of about 1 μm only on the rear surface not facing Li17-Pb83 alloy.

~3 Citings

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54. Design of inertial confinement fusion reactor driven by laser diode-pumped solid-state laser

By Mima, K.; Kitagawa, Y.; Takabe, H.; Yamanaka, M.; Nishihara, K.; Naito, K.; Hashimoto, T.; Norimatsu, N.; Yamanaka, T.; Izawa, Y.; et al

From [Plasma Physics and Controlled Nuclear Fusion Research \(1993\)](#), 14TH(3), 381-90. Language: English, Database: CAPLUS

Recently, high d. compression by laser implosion was achieved at ILE, Osaka University. By means of this expt., the requirements on the laser irradiation uniformity for direct drive implosion and pellet quality became clear. According to the database obtained by the expts., a laser fusion reactor for direct drive was designed. The radial convergence ratio of 30, which was achieved in the above direct implosion expts., implies that the av. d. of an imploded pellet could be >2000-fold the solid d. This means that a pellet gain >150 can be achieved with a multimegajoule laser pulse. Because the preliminary reactor design was presented at the 1990 IAEA Conference, Washington, the design of reactor pellet, reactor chamber (in particular, the first wall structure), laser diode (LD)-pumped solid-state laser, etc. were refined. This paper presents a conceptual design of the fusion reactor KOYOO-I driven by an LD-pumped solid-state laser operated at 12 Hz. The driver energy is assumed to be 4 MJ, which yields a gain of 150 according to the design. The net output elec. power is 2.6 GW. The first wall is made of liq. Li-Pb flows. The flows are guided by woven ceramic fiber pipes protecting the structure wall as well as breeding T.

~0 Citings

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55. Determination of bismuth in **lead** and in a **lead-lithium alloy** by stripping voltammetric assay

By Judex, P.; Heissler, S.; Adelhelm, C.

From [Fresenius' Journal of Analytical Chemistry \(1993\), 347\(10-11\), 413-16](#). Language: English, Database: CAPLUS, DOI:10.1007/BF00635467

The method developed allows the fast detn. of Bi in **lead** in the lower ng/mL range. It is not necessary to sep. the matrix so that any impairment of results caused by entrainment effects is eliminated. Compared to GFAAS, stripping voltammetry offers a means of detg. several elements. Also the linear range of the calibration curve extends over 3 decades. Using automated sampling, sample prepn. and transfer into the measuring vessel, the method is suited for application in a bypass mode so that the process of sepg. Bi from **lead** can be controlled. Among the elements studied, only Cu produces interference at a concn. excess >140 times.

~2 Citings

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56. Surface oxide layer as a barrier to tritium permeation through structural materials facing **lithium-lead** (17Li-83Pb) molten alloy

By Terai, Takayuki; Uozumi, Kouichi; Takahashi, Yoichi

Edited By:Ferro, C.; Gasparotto, Maurizio; Knoepfel, Heinz

From [Fusion Technol. 1992, Proc. Symp., 17th \(1993\), 2, 1518-22](#). Language: English, Database: CAPLUS

Permeation behavior of hydrogen isotopes through structural material in the presence of molten **lithium-lead alloy** (17Li-83Pb) was investigated in in-pile and out-of-pile expts. Deuterium permeation rate was strongly affected by the oxidn.-redn. of Fe surface with changing the oxygen potential in the secondary purge gas. In a reduced condition of Fe wall, the mass-transfer coeff. of deuterium showed almost the same value as that expected in the diffusion-limited case, while, in an oxidized state, it was smaller by one order in magnitude than the value in the diffusion-limited case. In the in-pile expt., SUS 304 as well as Fe was examd., and a large redn. ratio (2-3 orders in magnitude) for tritium permeation due to oxide layer formation was demonstrated.

~2 Citings

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57. On the concentration fluctuation and ordering potential of **lithium-lead** in the Bhatia-Young approach

By Bari, A.; Joarder, R. N.; Bhuiyan, L. B.

From [Physica Status Solidi B: Basic Research \(1993\), 177\(2\), 309-14](#). Language: English, Database: CAPLUS, DOI:10.1002/pssb.2221770206

An ordering potential is constructed out of the Thomas-Fermi type interaction between dissimilar species based on the concept of charge transfer and hence concn. dependent, to study the thermodyn. properties of the Li-Pb **alloy** in the Bhatia-Young formalism. It is fairly successful in predicting the exptl. behavior of the concn. fluctuation and the excess stability in the system.

~2 Citings

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58. Study on tritium release behavior from molten lithium-lead alloy (Li17Pb83) under neutron irradiation at elevated temperatures

By Terai, Takayuki; Uozumi, Kouichi; Takahashi, Yoichi

From [Nippon Genshiryoku Kenkyusho, \[Rep.\] JAERI-M \(1992\), \(JAERI-M-92-207, Proceedings of the Fourth International Symposium on Advan\), 258-66](#). Language: English, Database: CAPLUS

An in-situ T release expts. from $\text{Li}_{17}\text{Pb}_{83}$ was carried out by using the fast neutron source reactor YAYOI of the University of Tokyo. In the program named TREXMAN (T Release Expt. from Molten Li-Pb Alloy under Neutron Irradn.), the diffusion coeff. of T in Li-Pb and the overall mass-transfer coeff. from Li-Pb to purge gas under neutron irradiation in 300-700, which are very important parameters for T release from the material were obtained. Moreover, T release behavior through structural materials such as Fe and stainless steel type 304 in the presence of molten $\text{Li}_{17}\text{Pb}_{83}$ was studied at 600° under neutron irradiation. An anal. model was applied to the exptl. data on T permeation through the materials.

~0 Citings

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59. Corrosive effects of lead-lithium (Pb-17Li) water interaction

By Agostini, P.; Benamati, G.

Edited By: Clyne, T. W.; Withers, P. J

From [Proc. Eur. Conf. Adv. Mater. Processes, 2nd \(1992\), 3, 183-8](#). Language: English, Database: CAPLUS

The interaction between Pb-17Li and water, as a consequence of a localized tube microcrack, was studied. Two expts. were performed in which a low quantity of steam was injected into the Pb-17Li. The artificially machined microcracks, simulating a real microcrack in an AISI 316 heat exchanger tube, had a max. area of .003 mm². No blockage of the microcrack was obsd. during the tests. No significant damage was obsd. on the microcracks geometry, probably because of the short test time. A layer of reaction products having a high m.p. was formed around the test section. First anal. results seem to confirm the presence of lithium hydroxide in the reaction products.

~0 Citings

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60. Corrosion tests of austenitic materials in lithium-lead environment

By Agostini, P.; Benamati, G.

Edited By: Clyne, T. W.; Withers, P. J

From [Proc. Eur. Conf. Adv. Mater. Processes, 2nd \(1992\), 3, 177-82](#). Language: English, Database: CAPLUS

The corrosion of the steel AISI 321 and of the nickel based alloy Inconel 718 in a flowing lithium lead environment are studied in a thermal convection loop (TCL). The TCL has the following features: max. temp. 721 K, min. temp. 687 K, flow velocity .02 m/s, material AISI 316. Exptl. runs were performed from 300 h to 1900 h with an intermediate step of 1300 h. The amt. of corrosion rate is evaluated by wt. loss and by corrosion layer thickness. Two linear rates of corrosion are proposed. The results concerning AISI 321 fit well with literature data; on the other side no data exist for Inconel. A sensible difference in porosity of the corrosion layer is evidenced in the two cases. The concn. progresses of the various alloying elements in the matrix and in the transformed layer are evidenced by SEM/EDS technique. In both materials a sensible difference has been obsd. among the element concn. in the matrix and in the corrosion layer.

~0 Citings

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61. Thermodynamic and experimental evaluation of the sensitivity of lead-lithium (Pb-17Li) breeder blankets to atmospheric contamination

By Hubberstey, Peter; Sample, Tony

From [Journal of Nuclear Materials \(1992\), 191-194\(Pt. A\), 277-82](#). Language: English, Database: CAPLUS, DOI:10.1016/S0022-3115(09)80050-0

The stoichiometries of the reactions of Pb-Li alloys with atm. contaminants at 450° have been detd. by monitoring compn. changes in the alloy. Whereas hydrogen and nitrogen were inert, the oxygen contg. species, air, H₂O, CO₂ and CO, were reactive. The molar ratio of the reactants was Li:O = 2:1, suggesting Li₂O formation. Free energy data for reaction of these reagents [p = 1 bar] with Pb-Li alloys [$10^{-12} < x_{\text{Li}}(\text{at.}\%) < 10^2$; $327 < T(^{\circ}\text{C}) < 800$] have been derived; they confirm the exptl. results. Thus, whereas LiH and Li₃N formation is predicted to occur only at $x_{\text{Li}} > 80$ and > 84 at.% (750°), resp., Li₂O formation from air, H₂O, CO₂ and CO is favored at $x_{\text{Li}} > 10^{-12}$, $> 10^{-5}$, $> 3 \times 10^{-6}$ and $> 10^{-6}$ at.% (450°), resp.

~6 Citings

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62. Tritium release behavior from molten lithium-lead alloy by permeation through stainless steel type 304

By Terai, Takayuki; Uozumi, Kouichi; Takahashi, Yoichi

From *Journal of Nuclear Materials* (1992), 191-194(Pt. A), 272-6. Language: English, Database: CAPLUS, DOI:10.1016/S0022-3115(09)80049-4

Tritium release behavior through stainless steel type 304 as a structural material in the presence of molten $\text{Li}_{17}\text{Pb}_{83}$ was studied at 600° under neutron irradiation. The tritium permeation ratio to the secondary purge gas line was affected by the existence of H_2 in the purge gas. The tritium permeation rate changed with elapsed time, and decreased by 70% after 20 days since the start of an experiment series. This is attributed to the formation of an oxide layer on the SUS304 surface that is stable in H_2 atmosphere. An analytical model was applied to the experimental data on tritium release to obtain the mass transfer coefficient of tritium through the SUS304 tube.

~5 Citings

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63. Hydrogen transport through gas/liquid lithium-lead ($\text{Li}_{17}\text{Pb}_{83}$) interface and metal membrane contacting the alloy

By Tanaka, S.; Yamawaki, M.; Yokoo, K.; Kurita, K.; Kiyose, R.

From *Journal of Nuclear Materials* (1992), 191-194(Pt. A), 209-13. Language: English, Database: CAPLUS, DOI:10.1016/S0022-3115(09)80035-4

As basic studies on tritium recovery from $\text{Li}_{17}\text{Pb}_{83}$ and permeation through the metal contacting the alloy, lab. tests were conducted using hydrogen and deuterium. A disk-type metallic membrane (type 304 SS or α -iron) was dipped into the alloy. The hydrogen permeation rate through the membrane was proportional to the hydrogen pressure at 500°C. At 675°C for α -iron, it was proportional to the square root of the hydrogen pressure, lower than the ideal case when the bulk diffusion is rate-determining. The hydrogen transfer rate through the stagnant liquid-gas interface was proportional to the hydrogen pressure at 500°C. For the freshly produced interface by gas bubbling, hydrogen desorption rate was found to be larger by more than one order of magnitude than that for the stagnant surface. The deuterium transfer rate through the gas-liquid interface was found to be little affected by addition of hydrogen.

~2 Citings

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64. Behavior of SS316, with and without aluminization, in stagnant lead-lithium (Pb-17Li)

By Schreinlechner, I.; Sattler, P.

From *Journal of Nuclear Materials* (1992), 191-194(Pt. B), 970-4. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(92)90618-U

Austenitic SS316 sheet material, partly aluminized, was tested in static Pb-17Li (73 at% Pb and 17 at% Li), at 500°C. After 1000 h of exposure polished cross sections of pieces of the sample with and without aluminization were analyzed by electron microscopy and compared with the as-received sample. The unprotected surface revealed the expected depletion of alloying elements and the formation of a porous ferritic zone to a depth of ~200 μm into which Pb has penetrated. The aluminized surface does not show any attack by Pb-17Li nor penetration of Pb into the grain boundaries. An intermediate layer is found between the matrix and the aluminum surface layer, with distinct borders on either side, consisting of Al + Ni-rich areas, believed to be an AlNi alloy between Cr-rich areas. Quantitative analyses revealed identical concentrations of Al and Ni, for exposed as well as unexposed samples, indicating no counter diffusion to have taken place during the test.

~3 Citings

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65. Dissolution kinetics of steels exposed in lead-lithium and lithium environments

By Tortorelli, P. F.

From *Journal of Nuclear Materials* (1992), 191-194(Pt. B), 965-9. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(92)90617-T

An anal. of wt. loss kinetics was made for type 316 stainless steel and Fe-12Cr-1MoVW steel in thermally convective Pb-17 at.% Li (500°C) and lithium (600°C). For both steels, the kinetics are similar in lithium and Pb-17Li if the comparison is made at a temp. where soly.-driven mass transport dominates. At the temps. of this study, a model based on parilinear reaction kinetics accurately described the wt. loss curves for type 316 stainless steel in both liq. metals, while the ferritic steel rapidly achieved wt. losses that were linear with time. The differences between the kinetic behavior of the two steels can thus be interpreted in terms of the preferential dissoln. reactions and localized attack obsd. for the austenitic alloy.

~19 Citings

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66. The effects of hydrogen and lead-lithium (Pb-17Li) on the tensile properties of 1.4914 martensitic steel

By Sample, T.; Coen, V.; Kolbe, H.; Orecchia, L.

From *Journal of Nuclear Materials* (1992), 191-194(Pt. B), 960-4. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(92)90616-S

This paper describes the combined effect of hydrogen and liq. Pb-17Li on the tensile properties of DIN 1.4914 martensitic steel. Tensile tests at 1.1×10^{-4} and $2.8 \times 10^{-7} \text{ s}^{-1}$ were carried out on notched and non-notched tensile specimens. Comparison of the amt. of plastic strain at rupture for specimens tested in air, vacuum, hydrogen, Pb-17Li and Pb-17Li/hydrogen indicated that hydrogen does not dramatically embrittle DIN 1.4914. The plastic strain for specimens tested in Pb-17Li/hydrogen at 250°C was approx. equal to those tested in Pb-17Li. However at 400°C the plastic strain in Pb-17Li/hydrogen ($14.7 \pm 0.6\%$) was lower than in Pb-17Li only ($19.1 \pm 0.5\%$). A ductile fracture mode was obsd. in all of the tests. Slow strain rate tests at 250°C yielded serrated stress-strain curves. This phenomenon can be attributed to the Portevin-Le Chatelier effect of solute atom pinning of the dislocations.

~2 Citings

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67. Isothermal release of tritium from lithium-lead (Li₁₇Pb₈₃) alloy

By Nozaki, Tetsuya; Honda, Teruyuki; Aida, Masao; Okamoto, Makoto

From *Musashi Kogyo Daigaku Genshiryoku Kenkyusho Kenkyu Shoho* (1992), 18, 74-84. Language: Japanese, Database: CAPLUS

Tritium formed in Li₁₇Pb₈₃ alloy pellet irradiated in a nuclear reactor was recovered by heating at 150-400° for 90 min and in a He flow. Release rate of ³H increased greatly above 300°. Release at 300° was accelerated by adding 1% H₂ in He. Release rates at 350° and 400° were nearly the same. Release of gaseous component occupying a most part of released ³H did not agree with diffusion equations based on cylindrical and spherical models, because of low m.p. of Li₁₇Pb₈₃ (235°). Release of condensed component of ³H was better interpreted by bulk diffusion.

~0 Citings

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68. European research and development program for water-cooled lithium-lead blankets: present status and future work

By Giancarli, L.; Barbier, F.; Flament, T.; Futterer, M.; Leroy, P.; Proust, E.; Sannier, J.; Raepsaet, X.; Terlain, A.; et al.

From *Fusion Technology* (1992), 21(3, Pt. 2B), 2075-80. Language: English, Database: CAPLUS

A discussion with 28 refs. The European R&D program in support of the development of water-cooled Pb-17Li blankets for DEMO aims at improving the data base concerning tritium behavior and compatibility between blanket materials. The four main areas of the exptl. program are structural material corrosion by Pb-17Li, tritium extn. and permeation control, Pb-17Li physico-chem., and water/Pb-17Li interaction. The most significant results obtained to date in the various expts. performed in Europe and the future program required to complete the data base by 1994 are discussed.

~1 Citing

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69. Diffusion coefficient of tritium in molten lithium-lead alloy (Li₁₇Pb₈₃) under neutron irradiation at elevated temperatures

By Terai, Takayuki; Nagai, Shinichi; Yoneoka, Toshiaki; Takahashi, Yoichi
From [Journal of Nuclear Materials](#) (1992), 187(3), 247-53. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(92)90504-E

The diffusion coeff. of T in molten Li₁₇Pb₈₃ alloy (a candidate fusion reactor blanket material) was detd. under n irradsn. at 300-700°. T residence time in the exptl. system decreased with increasing H₂ pressure in He sweep gas up to 1000 Pa, and above this limiting concn. it became const. This result suggests that the T release rate was controlled only by the T diffusion processes in the molten Li₁₇Pb₈₃ alloy sample and in the Fe sample holder above P_{H2} = 1000 Pa. From the data on T residence time obtained in P_{H2} = 3000 Pa, the diffusion coeff. of T was detd. as follows: D/m² s⁻¹ = 2.50 × 10⁻⁷ exp(-27.0 kJ mol⁻¹/RT), which was slightly larger than the other literature values.

~23 Citings

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70. Oxygen in the liquid-metal fusion reactor blanket and its possible influence on the compatibility with materials

By Bhat, N. P.; Borgstedt, Hans U.
From [Fusion Technology](#) (1992), 21(1), 52-9. Language: English, Database: CAPLUS

Electrochem. O meters with Y-doped thoria, Y-stabilized zirconia, and Ca-stabilized zirconia solid electrolytes are tested for the measurement of O activity in Pb-17 Li eutectic alloy, the proposed breeder blanket fluid for fusion reactors. The O potentials of the alloy measured by these 3 m are compared with the O potentials of the alloy after the addn. of Li₂O and with theor. values. Zr and Y metal foils are tested for gettering O from the alloy. The compatibility of the 3 ceramic materials in the liq. alloy and the stability of the meters for prolonged use are discussed. The influence of O on the corrosion of steels in Pb-17Li is reviewed in light of the O potentials of the alloy compared to thermodyn. data of the ternary oxides of the metal constituents of steels. The possibility of using the O meters to measure the Li activity of the alloy is also indicated.

~12 Citings

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71. Tritium release behavior from molten lithium-lead alloy (Li17Pb83) by permeation through structural material

By Terai, Takayuki; Uozumi, Kouichi; Takahashi, Yoichi
From [Fusion Technology](#) (1992), 21(2, Pt. 2), 781-6. Language: English, Database: CAPLUS

Tritium release behavior through structural material in the presence of molten Li₁₇Pb₈₃ was studied in the TREXMAN program. Tritium permeation ratio to the secondary carrier gas line depends strongly upon H₂ pressure in He sweep gas of the primary and the secondary carrier gas lines. It increased with increasing H₂ pressure below 10⁴ Pa and above the value it became const. An anal. model was applied to the exptl. data on the tritium release to obtain the mass transfer coeff.

~3 Citings

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72. A nonlocal pseudopotential calculation of the resistivity of liquid metals and the lithium-lead alloy

By Akinlade, O.
From [Physica B: Condensed Matter \(Amsterdam, Netherlands\)](#) (1991), 175(4), 389-95. Language: English, Database: CAPLUS, DOI:10.1016/0921-4526(91)90075-P

The resistivity was calcd. of some liq. metals at temps. close to their f.p. using an ab initio nonlocal pseudopotential which incorporates high order perturbation effects. For the liq. metals, a comparison is made of the resistivity values obtained using the charged hard sphere (CHS) and the neutral hard sphere (NHS) ref. systems. A report of calcns. of the concn. dependent elec. resistivity of Li-Pb alloy incorporating effective mass correction is also detailed.

~2 Citings

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73. Radioactivity effects of lead-lithium (PB-17Li) in fusion power reactors

By Casini, G.; Rocco, P.; Zucchetti, M.

From [Fusion Engineering and Design \(1991\), 17, 351-7](#). Language: English, Database: CAPLUS, DOI:10.1016/0920-3796(91)90080-A

Research on the eutectic Pb-17Li is part of the blanket studies carried out in Europe for fusion power reactors. The use of this breeder makes easier some safety problems as compared to the case of Li as a consequence of the lower chem. reactivity of Pb-17Li. It increases the radioactivity problems due to the neutron activation of Pb and impurities. Both short-term (accidents) and long-term (waste disposal and recycling) aspects of the Pb-17Li activation products are discussed. They include the prodn., mobilization, release and environmental impact. Concerning accidents, a particular attention is given to ^{210}Po and ^{203}Hg . Questions related to waste management are also revised. The most attractive one seems that of recycling the spent Pb-17Li. This will be possible about 20 yr after removal from service. As an alternative to recycling, the breeder disposal as radioactive waste is discussed.

~1 Citing

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74. Mass transfer coefficient of tritium from molten lithium-lead alloy (Li₁₇Pb₈₃) to environmental gas under neutron irradiation

By Terai, Takayuki; Nagai, Shinichi; Yoneoka, Toshiaki; Takahashi, Yoichi

From [Fusion Engineering and Design \(1991\), 17, 237-41](#). Language: English, Database: CAPLUS, DOI:10.1016/0920-3796(91)90064-W

The mass transfer coeff. of T from molten Li₁₇Pb₈₃ alloy to environmental gas was detd. by in-situ T release expts. under neutron irradiation. in the temp. range from 400 to 700°. The T residence time in the sample in Al₂O₃ crucible was measured and a T release model was applied to obtain the mass transfer coeff. The mass transfer coeff. decreased with increasing H₂ partial pressure in He sweep gas up to 10⁴ Pa at 600°, and its max. value was 5.1 × 10⁻³[m s⁻¹]. At 10³ Pa in H₂ pressure, it was expressed as follows: $K_D = 2.5 \times 10^{-3}[\text{m s}^{-1}] \times \exp(-30.7[\text{kJ mol}^{-1}]/RT)$. From the dependence of K_D on H₂ pressure and the value of the activation energy in K_D , it was concluded that the rate-controlling process is a liq. film diffusion above 10³ Pa in H₂ pressure while, below 10² Pa, some surface reaction was considered to be a rate-controlling process.

~11 Citings

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75. Small-scale lithium-lead/water-interaction studies

By Kranert, O.; Kottowski, H.

From [Fusion Engineering and Design \(1991\), 15\(2\), 137-54](#). Language: English, Database: CAPLUS, DOI:10.1016/0920-3796(91)90221-B

One current concept in fusion blanket design is to utilize water as the coolant and liq. Pb-Li as the breeding/n multiplier material. Considering the complex design of the blanket module, it is likely that a water leakage into the liq. alloy may occur due to a tube rupture provoking an intolerable pressure increase in the blanket module. The pressure increase is caused by the combined chem. and thermohydraulic reactions of Pb-Li with water. Expts. which simulate such a transient event are necessary to obtain information which is important for the blanket module design. The interaction was investigated by conducting small-scale expts. at various injection pressures, alloy- and coolant temps. Besides using eutectic Li₁₇Pb₈₃, Li₇Pb₂, Li, and Pb were used. The expts. indicate increasing chem. reaction with increasing Li concn. At the same time, the chem. reaction inhibits violent thermohydraulic reactions due to the attenuating effect of the H produced. The preliminary exptl. results from Li₁₇Pb₈₃ and Li₇Pb₂ reveal that the pressure- and temp. transients caused by the chem. and thermohydraulic reactions lie within tech. manageable limits.

~8 Citings

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76. Characteristics of lithium-lead alloy as negative electrodes for lithium secondary batteries

By Ikawa, Kyoko; Namba, Masaru; Mizumoto, Mamoru; Nishimura, Shigeoki; Tamura, Kohki

From [Denki Kagaku oyobi Kogyo Butsuri Kagaku \(1991\), 59\(10\), 891-6](#). Language: Japanese, Database: CAPLUS

The reversibility of charging-discharging, the charge mass transfer resistances, and the impedance anal. of $\text{Li}_{3.5}\text{PbLa}_{0.03}$ as an anode were examd. in ethylene carbonate-propylene carbonate- $\text{MeOCH}_2\text{CH}_2\text{OMe}$ -Li fluorophosphate electrolyte. Potential plateaus were obsd. at 0.3-0.48, 0.49, and 0.52 V vs. Li/Li^+ , corresponding to the phase transitions $\text{Li}_7\text{Pb}_2 \rightarrow \text{Li}_3\text{Pb} \rightarrow \text{Li}_8\text{Pb}_3 \rightarrow \text{LiPb}$, resp. The sum of the charge transfer resistance and the ohmic resistance of the electrode increased with the charge-discharge cycles at 1.5 mA/cm^2 , indicating the accumulation of inactive Li on the electrode surface. The resistance by diffusion measured at charged and discharged states also increased due to the low diffusion rate for Li in Li-poor phases. The Li-Pb **alloy** electrode showed rather better cycle life than pure Li and Li-Al **alloy** electrodes.

~2 Citings

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77. Consequences of water injection into high-temperature **lithium-lead (Li17Pb83) alloy** breeder material

By Jeppson, D. W.; Savatteri, C.

From *Fusion Technology* (1991), 19(3, Pt. 2B), 1403-8. Language: English, Database: CAPLUS

A fusion safety expt. was conducted to det. the consequences of water injection into high-temp. Li-Pb **alloy** under postulated reactor accident conditions. The temp. and pressure response, fraction of water reacted, quantity of H produced, and behavior of radioactive species assocd. with the use of this **alloy** as a breeder material were detd. The reaction products were identified and the aerosol was characterized for particle size, chem. compn., and deposition rate. The water injection is self limiting for a blanket module designed to withstand the pressure of the water coolant. Radioactive doses assocd. with the aerosol release from a high-temp. **alloy** breeder module were detd. to be several orders of magnitude below the dose limit for acute health effects. The results were compared to previous expts. and recommendations were made.

~0 Citings

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78. Impact of a limiter on the tritium breeding and nuclear heating in a compact tokamak reactor

By Beynon, T. D.; Dhaba'an, A. H.

From *Annals of Nuclear Energy* (1992), 19(1), 17-26. Language: English, Database: CAPLUS, DOI:10.1016/0306-4549(92)90050-L

A detailed 3D Monte Carlo study was made of the effects on Ti breeding and nuclear heating of introducing a plasma-impurity limiter system in a high-power compact tokamak reactor. Considering natural Li and $\text{Li}_{17}\text{Pb}_{83}$ eutectic as candidate breeder materials, it was found that the T breeding ratio is reduced by 7.2% and 9.8%, resp. for these materials when the limiter is introduced. A negligible change of the total nuclear heating occurs for either choice of material, although the relative contributions of n and γ -ray heating does change.

~0 Citings

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79. Water interaction with **lithium-lead alloy** at 100-150°

By Dmitrievskaya, E. V.; Kirpal, V. I.; Lukashin, S. V.; Sorokin, S. I.; Tebus, V. N.

From *Vopr. Atom. Nauki i Tekhn. Ser. Termoyader. Sintez* (1990), (4), 51-5. Language: Russian, Database: CAPLUS

Title only translated.

~0 Citings

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80. Cycling performance and deterioration mechanism of **lithium-lead/polyaniline** battery

By Mizumoto, Mamoru; Namba, Masaru; Ikawa, Kyoko; Nakamura, Yasuo; Shishikura, Toshikazu

From *Denki Kagaku oyobi Kogyo Butsuri Kagaku* (1991), 59(10), 865-70. Language: Japanese, Database: CAPLUS

The factors detg. the charge-discharge cycle lifetime of $\text{Li}_{3.5}\text{PbLa}_{0.03}/\text{LiPF}_6/\text{polyaniline}$ were detd. The mech. strength was increased and the brittleness was decreased by addn. of La to the anode. The Li content of the anode decreased during cycling, but the coulomb efficiency was ~100% at 3.5 at.% Li utilization. IR anal. of the polyaniline cathode after cycling, suggested substitution of N with F, leading to performance deterioration.

~0 Citings

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81. In-reactor tritium release experiment from molten lithium-lead alloy (Li₁₇Pb₈₃)

By Terai, Takayuki; Nagai, Shinichi; Takahashi, Yoichi

From [Journal of Nuclear Materials](#) (1991), 179-181(Pt. B), 871-4. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(91)90227-X

An in-situ tritium release expt. from molten Li₁₇Pb₈₃ alloy was performed under n irradiation at 300-700° to investigate the chem. form and release rate of tritium. The dominant chem. form of the released tritium (>99.9%) from fresh Li₁₇Pb₈₃ was the water-insol. component (HT, T₂), irrespectively of the H₂ concn. in He carrier gas (0, 100, 1000, 10000 ppm). After 10 runs, however, the fraction of the water-insol. component decreased considerably, and depended strongly upon the H₂ concn. in He carrier gas. The tritium release rate was affected by the carrier gas compn. and flow mode (sweeping or bubbling). These results suggest that the tritium release is affected by a surface reaction on the molten alloy as well as diffusion and convection in the melt.

~2 Citings

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82. Thermophysical properties of the lithium-lead (Li(17)-Pb(83)) alloy

By Schulz, B.

From [Fusion Engineering and Design](#) (1991), 14(3-4), 199-205. Language: English, Database: CAPLUS, DOI:10.1016/0920-3796(91)90002-8

This paper describes a part of the work performed on the detn. of the thermophys. properties of alloys in the binary system Li-Pb. The prepn. of the eutectic alloy from the pure elements and its characterization using chem. anal., metallog., thermal and thermal differential anal. is described. Results of the measurements of the following properties are presented: latent heat of fusion, sp. heat, d., thermal expansion, thermal and elec. cond. and viscosity. The wetting behavior of Li(17)Pb(83) against SS 316 is discussed in terms showing the influence of esp. of O on the wetting angle in this system.

~22 Citings

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83. Coin-type polymer batteries

By Koseki, Mitsuru; Nakamura, Yasuo

From [Jpn. Kokai Tokkyo Koho](#) (1991), JP 03057170 A 19910312, Language: Japanese, Database: CAPLUS

The batteries use polyaniline cathodes, Li-Pb alloy anodes, and electrolytes of Li salts dissolved in aprotic solvents. The cathode may contain carbon materials, and the anode may contain La. These batteries have high capacity and long cycle life.

~0 Citings

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84. Electrical resistivity of compound forming alloys

By Mishra, A. K.; Sahay, B. B.

From [Physica Status Solidi B: Basic Research](#) (1991), 164(1), 267-74. Language: English, Database: CAPLUS, DOI:10.1002/pssb.2221640129

The harmonic model potential is used to explain the anomalous behavior in the elec. resistivity of Li-Pb and Na-Pb on the basis of pseudo-binary mixt. The Ziman-Faber formula can safely be used for the study of elec. resistivity of such ternary systems.

~3 Citings

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85. A mass transport model for hydrogen generation during lithium-lead/water interactions

By Biney, P. O.; Lomperski, S.; Corradini, M. L.; Krueger, J.

From [Proceedings - Symposium on Fusion Engineering \(1990\), 13th\(2\), 1125-8](#). Language: English, Database: CAPLUS

A mass transport chem. reaction model is presented to predict the rate of H generated in the interaction of Li₁₇Pb₈₃ with water. This model makes use of exptl. data to det. the rate of H generation from such as interaction. The model is used to det. diffusion rate consts. for the Li-Pb/water interaction. The results from the model indicate that the chem. reaction can be represented by a linear rate law, for the later times of the reaction (>10 s). However, the early stage of the chem. reaction does not follow a linear rate law. The results also indicate that for initial liq. metal temps. below 590°, the activation energy is not a function of the initial liq. metal temp.

~0 Citings

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86. Lamina polymer batteries

By Nakamura, Yasuo; Koseki, Mitsuru

From [Jpn. Kokai Tokkyo Koho \(1990\), JP 02220371 A 19900903](#), Language: Japanese, Database: CAPLUS

The batteries have polyaniline cathodes, Li-Pb anodes, and an electrolyte of Li salt in aprotic solvent. Li-Pb alloys for the anode may contain La, Mg and/or Y. These batteries have high capacity and long cycle life, and are capable of providing high current.

~0 Citings

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87. Lamina polymer batteries

By Koseki, Mitsuru; Nakamura, Yasuo

From [Jpn. Kokai Tokkyo Koho \(1990\), JP 02220369 A 19900903](#), Language: Japanese, Database: CAPLUS

The batteries have polyaniline cathodes, anodes contg. Li-Pb and Li-In alloy mixt., and an electrolyte of Li salt in aprotic solvent. The alloys may contain La, Mg and/or Y. These batteries have high capacity and long cycle life, and can provide high current.

~0 Citings

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88. Secondary nonaqueous lithium batteries

By Igawa, Michiko; Nishimura, Shigeoki; Mizumoto, Mamoru; Hida, Hiroshi; Ebato, Noboru; Nanba, Masaru; Takeuchi, Seiji

From [Jpn. Kokai Tokkyo Koho \(1990\), JP 02065056 A 19900305](#), Language: Japanese, Database: CAPLUS

The batteries use Li alloy anodes, which comprise particles of diam. 70-150 and 10-70 µm with the vol. ratio of coarse:fine particles 20-80%. The alloy is preferably a Li-Pb alloy. These batteries have long cycle life.

~0 Citings

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89. Monitoring system for chemical characterization of liquid breeder alloys

By De Schutter, F.; Dekeyser, J. A.; Luyten, J.; Tas, H.

From [Sensors and Actuators, B: Chemical \(1990\), 1\(1-6\), 446-50](#). Language: English, Database: CAPLUS, DOI:10.1016/0925-4005(90)80247-W

Electrochem. sensors for Li and O control in Li-Pb blends are being developed. Extension of the initially high operation temp. range of 673-773 K to a lower temp. range of 523-673 K could be achieved. For this purpose systematic emf vs. temp. test campaigns were run with particular attention to the effect of temp. on the response time. A monitoring system is presented, which allows full chem. characterization of the Li-Pb blends and which includes a dedicated data acquisition system.

~0 Citings

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90. Summary of lithium-lead alloy safety compatibility tests

By Jeppson, D. W.

From [Report \(1989\)](#), (WHC-EP-0202; Order No. DE89007310), 209 pp.. Language: English, Database: CAPLUS

Pb-17% Li reactions with air, N, CO₂, concrete, steam, and water were characterized to identify potential safety concerns assocd. with the use of the alloy as a breeding material in fusion reactors. Alloy-material reaction tests were conducted at ≤700° to characterize interactions at the highest accident temps. postulated for most proposed fusion reactors. Alloy pool-air interactions released limited quantities of heat and aerosols. Alloy spray reactions with air were mild. Alloy-pool reactions with concrete were limited to a reaction with water driven from the concrete. Alloy-steam and water reactions were limited by the Li present in the alloy. Alloy interactions are considerably less reactive than liq. Li in regards to heat generation, material consumption, and aerosol generation. Containment of potential radioactive species release from alloy interactions is necessary. Conventional filtration systems appear adequate to contain the limited quantities of aerosol released. It is necessary to control H release from alloy interactions with concrete, steam, and water.

~0 Citings

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91. Alloy/conducting-polymer composite electrodes: electrolytes, cathodes, and morphology

By Maxfield, M.; Jow, T. R.; Sewchok, M. G.; Shacklette, L. W.

From [Journal of Power Sources \(1989\)](#), 26(1-2), 93-102. Language: English, Database: CAPLUS, DOI:10.1016/0378-7753(89)80018-7

Alkali metal alloy-conducting polymer composite electrodes made with poly(p-phenylene)(I) and polyacetylene(II) had a high rechargeability for donor doping (cation insertion) in NaPF₆/1,2-dimethoxyethane, LiPF₆/2-methyltetrahydrofuran electrolytes, and in sulfolane and PhCN solvents at restricted potentials. Na-Pb, Li-Pb, and Li-Al alloys, formed as composites with I and II, were cycled exhaustively with excellent charge capacity retention. The composites form rechargeable cells with cation-inserting cathodes. Balanced cells having Na-Pb/I anodes and NaCoO₂ cathodes were cycled 250 times with little capacity loss. The good performance of these composites is due to the fibrillar morphol. of the polymer. After several cycles, the composites possess the fibrillar structure of pure polymer electrodes, with cryst. alloy uniformly distributed on or in the fibrils in particles of <0.2 μm. This structure, particularly when the fibrils are swollen with electrolyte, facilitates rapid transport of ions and electronic charge throughout the electrode.

~5 Citings

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92. Secondary button-type batteries

By Takeuchi, Masataka; Shishikura, Riichi; Konuma, Hiroshi

From [Jpn. Kokai Tokkyo Koho \(1989\)](#), JP 01134854 A 19890526, Language: Japanese, Database: CAPLUS

The title batteries have composite anodes comprising an alkali metal alloy, a polymer having conjugated double bond system, and a binder. Typically the alloy is an alkali metal-Pb alloys, the binder is EPDM, and the electrolyte for the batteries contains ≥50 vol.% ethers. These batteries have high voltage, high capacity, low self discharge and long lifetime.

~0 Citings

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93. The hard-sphere Yukawa model for anomalous thermodynamic properties of the liquid lithium-lead alloy

By Ginoza, Mitsuaki

From [Journal of the Physical Society of Japan \(1989\)](#), 58(7), 2601-2. Language: English, Database: CAPLUS, DOI:10.1143/JPSJ.58.2601

The mean spherical approxn. soln. of the Ornstein-Zernike direct correlation functions is given using the binary hard sphere Yukawa model. Calcns. of the excess Gibbs energy stability and isothermal compressibility of liq. Li-Pb gave reasonable agreement with exptl. results.

~1 Citing

94. Accommodation of liquid metal by cavity liners

By Jeppson, D. W.

From [Fusion Technology \(1989\), 15\(2, Pt. 2B\), 990-5](#). Language: English, Database: CAPLUS

Results of the Na tests support the conclusions that for inert atmospheres carbon steel liners 6.4 mm thick are adequate for postulated leakages of Li or Li-Pb alloy for leak temps. up to 600° and holding temps. at 800°. Steel liners appear to be adequate for alloy leakages at the same temps. in an air atm. Either stainless steel or thicker carbon steel liners are recommended to contain Li leaks where an air or steam atm. may be present. SOFIRE II and WATRE code predictions support the conclusions that for inert gas or limited air atmospheres, insulation behind the liner plate will be effective in minimizing water release from concrete and the attendant potential H prodn. for postulated Li leakages. The code predictions support the conclusion that insulation behind the liner will be effective in minimizing the potential for H prodn. for alloy leakages in air or inert gas atmospheres. Liner venting can be effective in minimizing the potential for H prodn. Stainless steel liners are more corrosion resistant than carbon steel when exposed to Li air reactions. Testing of Li and Li-Pb alloy with faulted liners should be considered. Testing of insulating materials interactions with Li and Li-Pb alloy would aid in selecting appropriate liner insulation.

~0 Citings

95. A new water-cooled lead blanket concept

By Cheng, E. T.; Creedon, R. L.; Wong, C. P. C.; Sze, D. K.

From [Fusion Technology \(1989\), 15\(2, Pt. 2A\), 669-73](#). Language: English, Database: CAPLUS

Pb has been widely investigated as a candidate blanket material in the form of Li-Pb (Li17Pb83) eutectic for D-T fueled fusion reactors. A new Pb blanket concept is conceived that could be cooled by pressurized water and which mitigates the potential Po and chem. activity concerns. One of the new ideas in the new Pb blanket concept is the minimization of the Li content in the Li-Pb material in order to further reduce the chem. activity with water. The min. Li concn. in this new Li-Pb alloy for achieving a T breeding ratio of 1.2 is 5 at.%. The other new idea is to mitigate the Po leakage concern by using sealed tubes contg. the recommended Li-Pb material. The bred T will permeate through the tube walls into the water coolant and be extd. The T inventory in the blanket will be primarily that in the water coolant, amounting to about 320 g.

~0 Citings

96. Tritium extraction from lead-lithium (Pb-17Li) samples

By Saibene, G.; Sartori, R.; Reiter, F.

From [Fusion Technology \(1988\), 14\(2, Pt. 2A\), 808-15](#). Language: English, Database: CAPLUS

The transport of T in liq. Pb-17Li was investigated for different types of capsules and different methods of T extrn. Equations describing the T release process have been set up and solved, and time-dependent expressions of the outcoming T flux were derived for closed capsules contg. stagnant or moving Pb-17Li and for capsules where a He + 0.1% H₂ flush gas sweeps the gas phase above the liq. Pb-17Li or bubbles through it. The anal. expressions of the outcoming T fluxes depend on T diffusivities and solys. in Pb-17Li and in the container material and on the T generation rate in Pb-17Li. The models allow the detn. of the characteristic T release times when these input parameters are available. The parameters can be detd. by fitting the exptl. T release data with the theor. flux equations. The characteristic T release time (time to reach 63.2% of the steady state T flux) is 14,000, 7200, 2000, and <100 s for the closed stagnant, closed convective, swept and bubbled capsule, resp., and for the specific conditions of the Libretto expt. (Petten - NL).

~1 Citing

97. Diffusion behavior of tritium formed in lithium-lead alloys by 14 MeV neutron irradiation

By Moriyama, Hirotake; Oishi, Jun; Kawamura, Kazutaka

From [Journal of Nuclear Materials \(1988\), 158, 137-42](#). Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(88)90163-8

T recovery expts. were performed with Li-Pb alloys irradiated with 14 MeV n. The effects of temp., alloy compn., and n fluence were obsd. on T recovery. T was released mainly as HT from the alloy and its release rate was controlled by bulk diffusion in the alloy. From the chem. anal. of T species in the alloy, it was found that free T atoms in the T⁰ state diffuse more rapidly than the others such as tritide ions in the T⁻ state. The diffusion mechanism for each species was discussed based on the obtained diffusion coeffs. Free T atoms might be trapped by radiation defects produced in the alloy.

~2 Citings

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98. Hydrogen behavior in liquid lithium-lead alloy (17Li83Pb)

By Fauvet, P.; Sannier, J.

From *Journal of Nuclear Materials* (1988), 155-157(Pt. A), 516-19. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(88)90301-7

In connection with fusion reactor blankets, the soly. and the diffusivity of H in the eutectic alloy 17Li83Pb were studied in a device esp. designed for taking into account the expected low level of soly. The structural materials were chosen as inert as possible to H, and a large amt. of alloy was used. The data obtained at 450° confirm the low ability of the alloy 17Li83Pb to contain H.

~0 Citings

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99. Corrosion of austenitic and martensitic stainless steels in flowing lithium-lead alloy (17Li-83Pb)

By Broc, M.; Flament, T.; Fauvet, P.; Sannier, J.

From *Journal of Nuclear Materials* (1988), 155-157(Pt. B), 710-14. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(88)90401-1

With regard to the behavior of 316 L stainless steel at 400° in flow anisothermal 17Li-83Pb the mass transfer suffered by this steel appears to be quite important without noticeable influence of const. or cyclic stress. Evaluation made from soln.-annealed specimens leads to a corrosion rate of approx. 30 µm yr⁻¹ at steady state to which a depth of 25 µm has to be added to take into account the initial period phenomena. On the other hand, with semi-stagnant 17Li-83Pb at 400°, the mass transfer of 316 L steel appears to be lower and more acceptable after a 3000-h exposure; but long-time kinetics data have to be achieved to see if that better behavior is persistent and does not correspond to a longer incubation period. As for the martensitic steels their corrosion rate at 450° in the thermal convection loop TULIP is const. up to 3000 h and 5 times lower than that obsd. for 316 L steel in the same conditions.

~0 Citings

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100. Isothermal release of tritium from neutron-irradiated Li₁₇Pb₈₃

By Shibuya, Yoshinori; Aida, Masao; Fujii, Yasuhiko; Okamoto, Makoto

From *Journal of Nuclear Materials* (1987), 150(3), 286-91. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(87)90006-7

Isothermal release expts. were carried out to study the Tr recovery from Li-Pb alloy Li₁₇Pb₈₃ in which Tr was produced by irradiation with thermal n. The Tr recovery was incomplete within 2 h at 200°. At temps. above the m.p., the Tr release rates were significantly increased and were controlled by the diffusion in the alloy. The detd. diffusion coeffs. of Tr in the alloy are 6.6 × 10⁻⁶, 7.8 × 10⁻⁶ and 9.5 × 10⁻⁶ cm²/s at 300, 400, and 500°, resp.

~6 Citings

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101. A helium cooled lithium-lead blanket for a DEMO tokamak reactor

By Baker, L. J.; Challender, R. S.; Coast, G.; Hopkins, M.; Lavender, K. E.; Needham, J.

From *Comm. Eur. Communities, [Rep.] EUR* (1986), (EUR 10936, Fusion Technol. 1986, Vol. 2), 1267-72. Language: English, Database: CAPLUS

The development is reported of a liq. Li-Pb blanket for a Demonstration tokamak reactor (DEMO) based on the geometric layout of the NET double null design. An adequate tritium breeding ratio and operating temps. suitable for an efficient steam cycle were achieved by incorporating a large proportion of Be in the Li-Pb breeder and by using He for the coolant.

~0 Citings

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102. The corrosion of 316 steel by lithium-lead alloys under nitrogen

By Watson, W. R.; Pulham, R. J.

From *Comm. Eur. Communities*, [Rep.] EUR (1986), (EUR 10936, Fusion Technol. 1986, Vol. 2), 969-72. Language: English, Database: CAPLUS

The 316 steel is corroded by Li-Pb alloys (fusion reactor T breeding material) under N₂ (6.5 to 18.2 kPa) at 851 to 951 K to form a surface layer of Li₉CrN₅. Exptl., the steel is covered with powd. Li₇Pb₂ (22.2 mol% Pb) and a pressure of N₂ is admitted which falls to an equil. value as the alloy is denuded of Li to a new compn. (52.8 to 58.9 mol% Pb) which provides the equil. Li activity. These data provide ΔG_R for the reaction $9\text{Li (in Li-Pb)} + \text{CrN} + 2\text{N}_2 = \text{Li}_9\text{CrN}_5$ and lead to ΔG_s° (Li₉CrN₅) for which the variation with temp. is given by ΔG_f° (Li₉CrN₅, kJmol⁻¹) = 0.70 T - 1073 (851 ≤ T ≤ 951 K). Extrapolation gives ΔG_f° , 298K = -840 kJmol⁻¹. At 1 atm pressure of N₂, all alloys contg. ≤55 mol% Pb are potentially corrosive towards 316 steel at 851-951 K. At lower temps. (709 K), extrapolation indicates that even the eutectic compn. (83 mol% Pb) would become corrosive under an atm. of N₂ although the rate would be exceedingly slow.

~0 Citings

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103. Tritium separation from lithium-lead blankets by permeation into a gas stream or into sodium-potassium

By Reimann, J.; Dinner, P.; Malang, S.; Wu, C.

From *Comm. Eur. Communities*, [Rep.] EUR (1986), (EUR 10936, Fusion Technol. 1986, Vol. 2), 1579-84. Language: English, Database: CAPLUS

Two methods are discussed: (1) the permeation through a wall with a high permeability coated at the downstream side with a catalyst layer to oxidize the T which then diffuses into a He stream for further processing; and (2) the permeation through a ferritic steel wall into a Na or NaK stream with T pptn. in a cold trap and recovery by thermal decompn. The fundamentals of the processes are illustrated, processing unit dimensions are estd. for a NET reactor, and problems to be investigated are summarized.

~0 Citings

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104. Tritium release from neutron-irradiated Li₇Pb₂ and Li₁₇Pb₈₃

By Vasilyev, V. G.

From *Comm. Eur. Communities*, [Rep.] EUR (1986), (EUR 10936, Fusion Technol. 1986, Vol. 2), 1505-9. Language: English, Database: CAPLUS

Li-Pb compds. have attracted considerable interest as a T breeding blanket materials for fusion reactors. The compns. of Li-Pb system such as Li₇Pb₂ and Li₁₇Pb₈₃ are potential candidate materials for fusion blanket. T release from N irradiated Li₇Pb₂ and Li₁₇Pb₈₃ was studied under isochronic conditions at 150-600 and 200-400°, resp. Kinetics of T release from N irradiated Li₁₇Pb₈₃ and Li₇Pb₂ with initial T concns. 2.5 10⁻²Ci/g and 1.5 10⁻¹Ci/g was studied in vacuum 1.3 Pa 250-320 and 150-425°, resp. The exptl. data were treated by the equations describing a chem. reaction. The processes are characterized by activation energies of 100 kJ/mol for Li₁₇Pb₈₃ and for Li₇Pb₂ 30 kJ/mol in range 150-300° and 96 kJ/mol in range 350-425°. After annealing at 450°, the residual T concns. are 3-3.7 × 10⁶ Bq/g.

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105. Interaction of hydrogen isotopes with the liquid eutectic alloy 17Li83Pb

By Reiter, F.; Camposilvan, J.; Gervasini, G.; Rota, R.

From *Comm. Eur. Communities*, [Rep.] EUR (1986), (EUR 10936, Fusion Technol. 1986, Vol. 2), 1185-90. Language: English, Database: CAPLUS

In connection with fusion reactor breeder blankets, soly., S, and diffusivity, D, of H and D in the eutectic alloy 17Li83Pb were detd. in the temp. range from the m.p. (508 K) to 700 K and at pressures of 10³-10⁵ Pa. The method used in these studies is based on the pressure increase measurements in a known vol. during unloading of cylindrical samples. The measured data of H and D and the extrapolated data of T are given in equation form.

~6 Citings

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106. On the concentration dependence of the ordering potential in liquid lithium-lead alloys

By Gallego, L. J.; Somoza, J. A.; Alonso, J. A.

From *Physics and Chemistry of Liquids* (1987), 16(4), 249-58. Language: English, Database: CAPLUS, DOI:10.1080/00319108708078527

The expression for the free energy of mixing arising from the Bhatia and Young (1984) approach is used to study the concn. fluctuations $S_{cc}(0)$ of liq. Li-Pb alloy. The exptl. behavior of $S_{cc}(0)$ can be explained by this theory if the ordering potential is assumed to vary strongly with concn. near the stoichiometric compn. Li_4Pb .

~5 Citings

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107. Manufacture of porous lithium-lead alloy anodes

By Kubota, Tadashi

From *Jpn. Kokai Tokkyo Koho* (1987), JP 62017950 A 19870126, Language: Japanese, Database: CAPLUS

Pb powder of 1-10- μ diam. contg. adsorbed water on the surface is added to molten Li in an inert atm. to form a porous powder by decomp. LiOH formed by the reaction between Li and the adsorbed water on Pb; the porous powder was then pressed and sintered to obtain porous Li-Pb alloy anodes. Pb powder was exposed to a 70-90% humidity atm. for 5-10 min, added in small amt. to molten Li, the mixt. was heated to 327° to melt Pb and to form Li-Pb alloy, and heated at >500° to decomp. LiOH. Powders spattered during the decompn. of LiOH and the porous surface layer of the cooled alloy were collected, pressed, and sintered to obtain Li-Pb anode. A secondary battery using this anode had a high efficiency.

~0 Citings

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108. Compatibility of 316L stainless steel with liquid and solid tritium breeding materials

By Broc, M.; Fauvet, P.; Flament, T.; Sannier, J.

From *Journal of Nuclear Materials* (1986), 141-143(Pt. B), 611-16. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(86)90063-2

Corrosion of 316L stainless steel [11134-23-9] in flowing 17Li-89Pb [73369-65-0] was investigated at 400 and 450° up to 3000 h exposures. At both temps., the steel develops a thick and porous ferrite layer, with an important Ni and Cr depletion. The influence on corrosion rate of temp., time, microstructure of steel, alloy velocity and cold trap purifn. is presented and discussed. The compatibility of 316L stainless steel with γ -LiAlO₂ [12003-67-7] ceramic was studied in 500 h contact tests under vacuum at 600 and 700°. A sulfidation of the contact surface, due to a sulfate impurity contained in the ceramic, was shown. These characterization tests have led the ceramics supplier to improve this material by decreasing its sulfur content to 100-200 ppm.

~3 Citings

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109. Corrosion of stainless steel in flowing lead-lithium eutectic

By Borgstedt, Hans U.; Frees, Guenter; Drechsler, Guenter

From *Journal of Nuclear Materials* (1986), 141-143(Pt. B), 561-5. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(86)90054-1

The corrosion of the AISI 304 steel [11109-50-5] in a flowing Li-Pb environment was studied in a loop which is equipped with an electromagnetic pump and flow meter. The loop is integrated in a dry-Ar glove box system. The tubes of the loop are of austenitic steel AISI 316 Ti, and the whole circuit contains about 3 L of the molten metal. The prefabricated alloy Pb-17 at.% Li [73369-65-0] delivered in solid bars is analyzed by chem. methods and by measurement of the m.p. The internal heating rod of 3 kW power heats the liq. metal to the test temp. of 420°; the flow velocity is within the range 10-20 cm/s. The eutectic does not dissolve measurable amts. of the steel elements, and O is in the <10⁻³ wt.% level. The corrosion effects after an exposure of up to 5750 h were evaluated. The wt. loss of the steel specimens interferes with the formation of a Pb contg. surface cover.

~7 Citings

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110. Electric contacts from silver-lithium-lead alloy

By Tsuji, Masayuki; Takegawa, Yoshinobu

From [Jpn. Kokai Tokkyo Koho \(1986\)](#), JP 61194129 A 19860828, Language: Japanese, Database: CAPLUS

The Ag alloy contains Li 0.5-3, Pb 3-6, and ≥ 1 of In, Al, Si, Cu, Zn, Ga, Cd, Sn, and/or Sb 0.1-5%, and is internally oxidized to have dispersed oxides. The elements of last group swell on oxidn. Thus, Ag alloy ingot contg. Pb 3, Li 0.5, and Sn 2% was annealed in N, cut to 1 mm thickness, trimmed, processed into 5-mm diam. contacts, and heated at 700° in O. The no. of seizures was 6 when on-off tested for 10⁴ cycles at a.c. 100 V, 20 (max. 118) A, contact 100 and releasing force 150 g, and Vickers hardness was 105, compared to 13 and 80 without Sn addn.

~0 Citings

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111. A study on tritium separation from lithium-lead alloy by permeation into sodium or sodium-potassium alloy and cold trapping

By Reimann, J.; Malang, S.

From [Kernforschungszent. Karlsruhe](#), [Ber.] KfK (1986), (KfK 4105), 85 pp.. Language: English, Database: CAPLUS

A review with 46 refs. is given on the tritium sepn. and recovery method, which is a very promising technique for a LiPb self-cooled blanket, where an intermediate loop is required for safety reasons.

~0 Citings

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112. Thermophysical properties in the system lithium-lead. Part II: Thermophysical properties of the lithium-lead 83 eutectic alloy

By Jauch, U.; Haase, G.; Schulz, B.

From [Kernforschungszent. Karlsruhe](#), [Ber.] KfK (1986), (KfK 4144), 25-44. Language: English, Database: CAPLUS

Methods of measurements and results for the following properties for Li-Pb (17-83) alloy are presented: d., sp. heat latent heat of fusion, surface energy, thermal cond. and diffusivity, elec. cond., and viscosity. The range of the temp. for extrapolation of the phys. properties is discussed.

~3 Citings

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113. Thermophysical properties in the system lithium-lead. Part I: Preparation and characterization of the lithium-lead 83 eutectic alloy and the lithium-lead intermetallic compound

By Jauch, U.; Karcher, V.; Schulz, B.

From [Kernforschungszent. Karlsruhe](#), [Ber.] KfK (1986), (KfK 4144), 2-24. Language: English, Database: CAPLUS

The title alloy and LiPb were prepd. from the pure elements in amts. of several hundred grams. The resolidified samples were characterized by m.ps. (eutectic temp.), chem. anal. and metallog.. By using DTA the heats of fusion were detd. and the behavior of the intermetallic phase LiPb in vacuum and high purified He was studied. The results from these investigations were used to characterize the alloy prepd. in higher amts. for tech. application as a potential liq. breeder material.

~1 Citing

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114. Secondary lithium batteries

By Kitagawa, Satoshi; Yoshimitsu, Kazumi; Kajita, Kozo

From [Jpn. Kokai Tokkyo Koho \(1986\)](#), JP 61066370 A 19860405, Language: Japanese, Database: CAPLUS

Batteries use a Li ion-conductive electrolyte, a cathode, and an anode of Li-Pb alloys contg. Mg, Ca, Ga, In, Si, Ge, and/or Sn. The cathode may be chalcogenides of transition metals. The anode alloys promote alloy formation with Li deposited by charging and also increase the cycle life of batteries. Thus, an anode was prepd. by pressing a pulverized 30:56:14 (at. ratio) Li-Pb-Mg alloy prepd. by melting under Ar. A battery using this anode, a TiS_2 -PTFE cathode, and 1M LiPF_6 in 60:35:5 4-methyl-1,3-dioxolane-MeOC₂H₄OMe-hexamethylphosphoramidate electrolyte provided 1460 charge-discharge cycles until the capacity decreased to a limit. The resp. cycle lives for control batteries using a Li or 3:7 Li-Pb alloy anode were 121 or 1109 cycles, under the same conditions.

~0 Citings

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115. Secondary battery

By Koshiba, Nobuharu; Momose, Keigo; Hayakawa, Hayashi; Ikehata, Toshihiko
From *Jpn. Kokai Tokkyo Koho (1986)*, JP 61029069 A 19860208, Language: Japanese, Database: CAPLUS

A button-type battery comprises activated C cathode, a Pb-(3-30%) Bi or Pb-(3-30) Bi-(20-50%) Cd alloy anode, which reversibly occludes and releases Li^+ ions, and a nonaq. electrolyte contg. Li^+ ions. Thus, several batteries were prepd. with cathodes (diam. 15, thickness 1 mm) contg. activated C and a fluorocarbon resin, anodes of different Pb-Bi-Cd alloys (diam. 15, thickness 0.1 mm) pressed to Li films, and a 1M LiBF_4 in 1:1 propylene carbonate-MeOC₂H₄OMe electrolyte. On cycling after storing for 1 mo at 60° and a 90% relative humidity, the capacity retention ratio was higher for batteries using Pb-(3-30)% Bi anodes than for batteries using Pb anodes, and the ratio was further increased by addn. of Cd to the alloy.

~0 Citings

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116. Solid-state lithium secondary batteries

By Nagai, Tatsu; Kajita, Kozo
From *Jpn. Kokai Tokkyo Koho (1985)*, JP 60257073 A 19851218, Language: Japanese, Database: CAPLUS

An anode for the title batteries consists of a Li-Pb alloy and is formed by vacuum deposition including simultaneous or flash deposition. The batteries have high charge-discharge performances due to an enhanced migration of Li in the anode and prevention of Li dendrite formation. Thus, a glass base was deposited with a TiS_2 layer by chem. vapor deposition using TiCl_3 and H_2S ; the TiS_2 cathode was deposited with amorphous 6- μ Li_4SiO_4 - Li_3PO_4 electrolyte layer by using solid salt soln. as the target, and the electrolyte was simultaneously deposited with Li and Pb, controlling the target temps. to obtain a 6:4 (at. ratio) Li-Pb alloy layer. The amt. of Li corresponded to 3mA-h/cm² electricity. The obtained battery had an open-circuit voltage (V) of 2.1 V. A control battery using Li anode had V = 2.4 V. After 2000 cycles between 2.7 and 1.2 V, the resp. capacities for Li-Pb alloys and control battery were 0.35 and 0.22 mA-h/cm².

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117. Observation of the strongly anomalous temperature and composition dependence of ($\delta p/\delta T$)s in liquid lithium/lead alloys

By Saar, J.; Ruppertsberg, H.
From *Physics Letters A (1985)*, 113A(3), 161-3. Language: English, Database: CAPLUS, DOI:10.1016/0375-9601(85)90164-1

The values ($\delta p/\delta T$), which are proportional to the sp. heat were measured between the liquidus temp. and 1250 K for the whole concn. range of liq. Li/Pb alloys. For all concns., there are pos. deviations from the values expected for an ideal soln. and there is a narrow peak close to the compn. Li_4Pb . At $0.2 < x_{\text{Li}} < 0.6$ a fall off after melting is followed by a broad max. at about 1000 K.

~0 Citings

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118. Safety considerations of lithium lead alloy as a fusion reactor breeding material

By Jeppson, D. W.; Muhlestein, L. D.
From *Fusion Technology (1985)*, 8(1, Pt. 2B), 1385-91. Language: English, Database: CAPLUS

Test results and conclusions are presented for Li-Pb alloy interactions with various gas atmospheres, concrete, and potential reactor coolants. The reactions are characterized to evaluate the potential of volatilizing and transporting radioactive species assocd. with the liq. breeder under postulated fusion reactor accident conditions. The safety concerns identified for Li-Pb alloy reactions with the above materials are compared to those previously identified for a ref. fusion breeder material, liq. Li. Conclusions made from this comparison are also included.

~2 Citings

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119. Analysis of tritium permeation through the structural material of the blanket containing liquid 83Pb17Li as breeding material

By Pierini, G.; Baratti, R.; Polcaro, A. M.; Ricci, P. F.; Viola, A.

From [Comm. Eur. Communities, \[Rep.\] EUR \(1984\), \(EUR 9183, Fusion Technol., Vol. 2\), 1059-67](#). Language: English, Database: CAPLUS

The choice of the liq. 83Pb17Li [73369-65-0] alloy as a blanket material for fusion D-T reactors is handicapped by the high T pressure, due to its low soly., which favors permeation through the metallic walls. However, the growth of an oxide layer on the inside of the cooling system tubes can appreciably reduce the permeation. A math. model was developed suitable for detg., as a function of the operative parameters, the min. redn. factor that the oxide layer should have to permeation in order to limit the T losses to acceptable levels. The operating conditions for which the T permeability is maintained between acceptable values comparable to those expected in the first wall coolant (10^{-2} g-d⁻¹) are given.

~0 Citings

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120. Corrosion of 316L stainless steel in flowing 17Li83Pb alloy

By Fauvet, P.; Sannier, J.; Santarini, G.

From [Comm. Eur. Communities, \[Rep.\] EUR \(1984\), \(EUR 9183, Fusion Technol., Vol. 2\), 1003-9](#). Language: English, Database: CAPLUS

The corrosion resistance of 316L stainless steel [11134-23-9] in the presence of flowing 17Li83Pb alloy [73369-65-0] was studied, in view of fusion reactor application, in a thermal convection loop in the following exptl. conditions: hot leg temp. 450°, temp. difference between hot leg and cold leg 60°, velocity ~0.12 m.s⁻¹, and test duration 3000 h. The specimens placed in the isothermal hot leg of the loop suffered an attack to a depth of ~40 µm and was covered by a porous corrosion layer constituted of ferrite and of a network of channels filled with lithium-lead alloy.

~0 Citings

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121. Influence of a magnetic field on liquid metal corrosion

By Malang, S.

From [Comm. Eur. Communities, \[Rep.\] EUR \(1984\), \(EUR 9183, Fusion Technol., Vol. 2\), 979-84](#). Language: English, Database: CAPLUS

A model was developed describing the 2-dimensional transport of wall material in liq. metal flow. This model was used to investigate the influence of a magnetic field on the corrosion in a liq. metal cooled blanket. A comparison between calcd. and measured results shows reasonable agreement for a forced convection loop expt.

~1 Citing

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122. Solubility of hydrogen in liquid 17Li83Pb alloy

By Fauvet, P.; Sannier, J.; Santarini, G.

From [Comm. Eur. Communities, \[Rep.\] EUR \(1984\), \(EUR 9183, Fusion Technol., Vol. 2\), 1425-30](#). Language: English, Database: CAPLUS

In connection with studies on T breeding, the soly. of H in the liq. 17Li83Pb alloy was evaluated in the 400-500° temp. range for low (~1 mbar) and high (~1000 mbar) H partial pressures. No noticeable difference in the order of magnitude of the Sieverts' ratio was obsd. between both ranges of pressure. Moreover, for high partial pressures, the Sieverts' ratio does not appear to be modified by the presence of Li₂O in contact with the alloy.

~0 Citings

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123. Susceptibility of 2 1/4 Cr-1Mo steel to liquid metal induced embrittlement by lithium-lead solutions

By Eberhard, B. A.; Edwards, G. R.

From [Report \(1984\)](#), (UCRL-15639; Order No. DE85000997), 130 pp.. Language: English, Database: CAPLUS

An investigation was conducted on the liq. metal-induced embrittlement susceptibility of 2 1/4Cr-1Mo steel [39362-68-0] exposed to Li and 1at.%Pb-Li [95788-08-2] 190-525°. This research was part of an ongoing effort to evaluate the compatibility of liq. Li solns. with potential fusion reactor containment materials. Of particular interest was the microstructure in the weld heat-affected zone, a microstructure known to be highly susceptible to corrosive attack by liq. Pb-Li solns. Embrittlement susceptibility was detd. by conducting tension tests on 2 1/4Cr-1Mo steel exposed to an inert environment as well as to a Pb-Li liq. and observing the change in tension behavior. The 2 1/4Cr-Mo steel was also given a base plate heat treatment to observe its embrittlement susceptibility to 1 at.% Pb-Li. The base plate microstructure was severely embrittled at <500°. Tempering the base plate was effective in restoring adequate ductility to the steel.

~0 Citings

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124. The interaction of hydrogen isotopes with lithium-lead alloys

By Wu, C. H.

From [Journal of Nuclear Materials \(1984\)](#), 123(1-3), 941-5. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(84)90199-5

Sievert's law is valid to H isotope concns. in Li-Pb as high as a few hundred ppm. in the Li-rich region. From the anal. of the thermodyn. properties, the energy, E, required to place a free D atom into the lowest bound state in Li-Pb is 60 kcal/mol in the region $X_{Li} \geq 0.9$ and -3.95 kcal/mol in region $X_{Li} \leq 0.17$. These values are close to the bond dissocn. energies of LiH and of PbH. H has a strong interaction in the Li-rich and Pb-rich regions.

~0 Citings

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125. Tritium breeding benchmark calculations for a lithium-lead (Li₁₇Pb₈₃) blanket with steel structure

By Huang, Jin Hua; Sawan, Mohamed E.

From [Fusion Technology \(1984\)](#), 6(2, Pt. 1), 240-52. Language: English, Database: CAPLUS

Breeding calcns. for a Li₁₇Pb₈₃ benchmark problem that employs steel as structure are presented. Large deviations between the results of continuous energy Monte Carlo and multigroup discrete ordinates are obsd. when different multigroup libraries are used. Effects of group structure and weighting spectra are explored by collapsing the Los Alamos National Lab. 80-group library into different broad group structures using different weighting spectra. For blanket systems with natural LiPb, many groups with fine structure in the Fe resonance region are required for accurate T breeding detn. Fewer broad groups can be used only if an appropriate weighting spectrum representing the spectrum in the Li₁₇Pb₈₃ system is used to generate the data. For systems highly enriched in ⁶Li, these effects are less pronounced with fewer groups being adequate.

~1 Citing

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126. Conceptual design of two helium cooled fusion blankets (ceramic and liquid breeder) for INTOR

By Dalle Donne, M.; Dorner, S.; Taczanowski, S.

From [Report \(1983\)](#), (KFK-3584, EUR-7987-e), 60 pp.. Language: English, Database: CAPLUS

Neutronic and heat transfer calcns. were performed for 2 He cooled blankets for the INTOR design. The neutronic calcns. show that the local T breeding ratios, both for the ceramic blanket of Li_2SiO_3 [10102-24-6] and for the liq. blanket $\text{Li}_{17}\text{Pb}_{83}$ [73369-65-0] solns., are 1.34 for natural T and ~ 1.45 using 30% ^6Li enrichment. The heat transfer calcns. show that it is possible to cool the divertor section of the torus (heat flux = 1.7 MW/m^2) with He with an inlet pressure of 52 bar and an inlet temp. of 40° . The temp. of the back face of the divertor can be kept at 130° . With He with the same inlet conditions it is possible to cool the 1st wall as well (heat flux = 0.136 MW/m^2) and keep the back-face of this wall at a temp. of 120° . For the ceramic blanket, He was used with 52 bar inlet pressure and 400° inlet temp. to ensure sufficiently high temps. in the breeder material. The max. temp. in the pressure tubes contg. the blanket is 450° , while the max. breeder particle temp. is 476° .

~0 Citings

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127. Solubility of hydrogen in the molten lithium-lead (Li₁₇Pb₈₃) alloy

By Pierini, Giancarlo; Polcaro, Anna M.; Ricci, Pier F.; Viola, Antonio
From *Journal of Chemical and Engineering Data* (1984), 29(3), 250-3. Language: English, Database: CAPLUS, DOI:10.1021/je00037a007

The equil. H_2 (dissolved) in liq. $\text{Li}_{17}\text{Pb}_{83}$ [73369-65-0] was studied at various temps. to obtain thermodyn. data required for use of the alloy as a blanket for nuclear fusion reactors. The system $\text{Li}_{17}\text{Pb}_{83}\text{-H}$ is characterized by large deviations from ideal behavior with increasing H concn. An empirical equation which correlates the activity coeffs. and H concn. in the alloy is proposed.

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128. The solubility of hydrogen, deuterium, and tritium in liquid lead-lithium alloys

By Hoch, Michael
From *Journal of Nuclear Materials* (1984), 120(1), 102-12. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(84)90177-6

In connection with fusion reactor technol., the soly. of H, D, and T in liq. Pb-Li alloys was calcd., as a function of compn. and temp. by using the thermodyn. data of the binary systems. In the 17 at.% Li alloy at 600 K, the D soly. is $\log K = -4.20 \pm 0.076$, K in at. ppm. torr^{-1/2}, that of H is -4.125 ± 0.076 , and that of T is -4.244 ± 0.076 . The calcd. values give a much lower soly. than the exptl. data. A ternary H-Li-Pb interaction term must be postulated to get agreement between exptl. and calcd. results.

~8 Citings

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129. Structure of multicomponent hard-sphere mixtures - application to the liquid lithium-lead alloy

By Hoshino, Kozo
From *Journal of Non-Crystalline Solids* (1984), 61-62(1), 529-34. Language: English, Database: CAPLUS, DOI:10.1016/0022-3093(84)90600-8

The general formulas for the partial and the total structure factors of an m-component mixt. are obtained. The explicit expressions can be obtained for the hard-sphere mixt. based on the exact soln. of the Percus-Yevick equation. The formulas are applied to the liq. Li-Pb alloy and the theor. results for the total structure factor and its temp. dependence are in good agreement with the recent exptl. results of Ruppertsberg and Reiter (1982).

~0 Citings

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130. A model for the structure of liquid lithium lead [Li₄Pb]

By Copestake, A. P.; Evans, R.; Ruppertsberg, H.; Schirmacher, W.
From *Journal of Physics F: Metal Physics* (1983), 13(10), 1993-2010. Language: English, Database: CAPLUS, DOI:10.1088/0305-4608/13/10/011

Calcns. are presented of the partial structure factors and radial distribution functions of liq. Li_4Pb at different temps. Assuming that this alloy is partially ionic, the interionic forces are modeled by pairwise potentials that are strongly repulsive at small sepn. (r) and electronically screened Coulombic at large r . This model arises from the fact than an r -dependent ordering potential, which exhibits approx. screened Coulombic decay for large r , can be extd. from the neutron diffraction data for $S_{\text{CC}}(q)$ in Li_4Pb . The calcns., which are based on the mean-spherical and the hypernetted-chain approxns., show that the wavenumber dependence of the measured concn. structure factor $S_{\text{CC}}(q)$ can be reasonably well accounted for by the model with effective electron charges of -0.5 and -2.0 at the Li and Pb sites, resp., and an inverse screening length of 1.1 \AA^{-1} . These parameters are consistent with values obtained from the ordering potential extd. from expt. In order to explain the obsd. temp. dependence of $S_{\text{CC}}(q)$ it is necessary to assume that the charge transfer between species decreases with increasing temp.

~18 Citings

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131. Structure of multicomponent hard-sphere mixtures: application to the liquid lithium-lead alloy

By Hoshino, Koza

From *Journal of Physics F: Metal Physics* (1983), 13(10), 1981-92. Language: English, Database: CAPLUS, DOI:10.1088/0305-4608/13/10/010

A general formula for the partial structure factors of an m -component mixt. is derived. The compressibility of the mixt. obtained by J. G. Kirkwood and F. P. Buff (1951) can be written in terms of the partial structure factors in the long-wavelength limit. For the m -component hard-sphere system, the explicit expressions for the partial structure factors are obtained based on Hiroike's exact soln. of the Percus-Yevick equation. The formulas are applied to the liq. Li-Pb alloy, which is considered as a ternary mixt. of Li, Pb, and Li_4Pb . The theor. total structure factor agrees with that obsd. by H. Ruppertsberg and H. Reiter (1982).

~25 Citings

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132. On the temperature dependence of the structure factor of the liquid lithium-lead alloy

By Hoshino, Koza

From *Journal of Physics F: Metal Physics* (1983), 13(10), L189-L191. Language: English, Database: CAPLUS, DOI:10.1088/0305-4608/13/10/001

The temp. dependence of the total structure factor of the liq. $\text{Li}_{0.8}\text{Pb}_{0.2}$ alloy obtained exptl. by H. Ruppertsberg and H. Reiter (1983) can be understood qual. within the compd.-forming model by taking into account the temp. dependence of the total packing fraction and the fraction of the mol.

~3 Citings

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133. A study of the interaction of tritium with liquid lithium-lead ($\text{Li}_{17}\text{Pb}_{83}$)

By Wu, C. H.; Blair, A. J.

From *Comm. Eur. Communities, [Rep.] EUR* (1983), (EUR 7983, Fusion Technol. 1982, vi), 699-704. Language: English, Database: CAPLUS

$\text{Li}_{17}\text{Pb}_{83}$ [73369-65-0] was irradiated in a fission reactor to give concns. of T within the range 1-50 at. ppm. The concn. of T in the irradiated alloy was detd. by combustion in O followed by liq. scintillation counting. The compn. of the gas released upon fusion of the irradiated alloy in vacuum was detd. by mass spectrometric Knudsen effusion anal. The principal species detected were HT, HTO, and T_2 ; the ratios of these were dependent on the T concn. and the purity of the alloy sample. Sieverts const. of T for this alloy was $(5.82 \pm 1.8)10^3 \text{ atm}^{-1/2}$; which is in accordance with that for D in the same alloy.

~0 Citings

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134. The solubility of deuterium in lithium-lead alloys

By Wu, C. H.

From *Journal of Nuclear Materials* (1983), 114(1), 30-3. Language: English, Database: CAPLUS, DOI:10.1016/0022-3115(83)90069-7

The soly. of D in Li-Pb alloys [37232-97-6] was measured as a function of temp. and at. fraction of Li, X_{Li} . At the at. fraction $X_{Li} = 0.78$, corresponding to the compn. Li_7Pb_2 , the soly. in the solid phase is lower by a factor of a few hundred than that in the liq. phase. The soly. of D in the Li-Pb system decreases drastically with decreasing X_{Li} . At $\sim X_{Li} = 0.17$, which corresponds to the eutectic $Li_{17}Pb_{83}$, the soly. is independent of temp. The transition from exothermal to endothermal dissoln. occurred at $\sim X_{Li} \leq 0.17$.

~12 Citings

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135. The solubility of hydrogen, deuterium and tritium in liquid **lead-lithium** alloys in the temperature region 500-1500 K

By Hoch, Michael

From [Kernforschungscent. Karlsruhe, \[Ber.\] KFK \(1982\), \(KFK 3269\), 30 pp.](#) Language: English, Database: CAPLUS

The soly. of H_2 , D_2 and T_2 in liq. Pb-Li alloys was calcd. by using the thermodyn. data for the binary systems. At 500-1500 K and compn. range $.01 < x_{Li} < 0.6$, the soly. is almost temp. independent and it is not strongly influenced by the soly. of H_2 in pure Pb.

~0 Citings

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136. In-situ tritium recovery from **lithium-lead (Li17Pb83)** breeding blanket

By Sze, Dai Kai

From [Proceedings - Symposium on Engineering Problems of Fusion Research \(1981\), 9th\(2\), 1213-16.](#) Language: English, Database: CAPLUS

$Li_{17}Pb_{83}$ [73369-65-0] is an attractive breeding material owing to its high T breeding potential, low T soly. and relative inertness toward water. In previous designs, $Li_{17}Pb_{83}$ was used both as the breeding material and the coolant. The high T partial pressure, caused by the low T soly., resulted in considerable difficulties in T confinement. In addn., there are problems assocd. with corrosion and corrosion product transport, pumping equipment cost, and for a magnetic confinement system, MHD problems. These problems can be alleviated by using static $Li_{17}Pb_{83}$ only as a breeding material. A gas coolant confined in a coolant tube is used as the cooling medium. The T concn. in the blanket is allowed to increase and, finally, T will diffuse toward the plasma or the coolant stream. The required T partial pressure is 10^{-2} torr, which corresponds to a T concn. in $Li_{17}Pb_{83}$ of only 6 WPPB. Because the primary heat exchanger now does not see this high T partial pressure, T confinement becomes much easier. The gas coolant proposed for use is high-pressure steam. The higher d. of the steam compared to that of the H will reduce the pumping power required by a factor of 2. The T recovery from steam is straightforward if the concn. is high enough.

~0 Citings

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137. Contribution to the causes of improved creep strength in **lead-alkali metal alloys**

By Akyol, A.; Borbe, P. C.; Erdmann-Jesnitzer, F.

From [Metall \(Isernhagen, Germany\) \(1982\), 36\(4\), 401-9.](#) Language: German, Database: CAPLUS

Under normal pressure conditions, H is insol. in molten or solid Pb. Bonded as well as free or diffusible H was confirmed by NMR measurements in Pb alloys with alkali metals, e.g., Li. H in the α -Pb-Li-H solid soln. can be responsible for its good creep resistance. Contrary to the usually proposed statistical distribution, a theory of H accumulation in the neighborhood of Li ions in forms of local geometric concns. or special coherent zones is considered.

~0 Citings

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138. Use of **lithium** in fusion reactors

By Blink, J. A.; Krikorian, O. H.; Hoffman, N. J.

From [ACS Symposium Series \(1982\), 179\(Met. Bonding Interact. High Temp. Syst. Emphasis Alkali Met.\), 497-542.](#) Language: English, Database: CAPLUS, DOI:10.1021/bk-1982-0179.ch033

The use of Li as a solid compd., a pure melt, or a molten alloy is required for T breeding in at least the 1st generation of fusion reactors. Three fusion reactor concepts are discussed with emphasis on material selection and material compatibility with Li. Engineering details designed to safely handle molten Li are described for 1 of the example concepts. The T recovery from the various breeding materials is discussed. Finally, 2 aspects of the use of molten Li-Pb alloys are discussed: the soly. of H isotopes, and the influence of the alloy vapor on heavy ion beam propagation.

~0 Citings

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139. Comments on the hydrogen solubility data for liquid lead, lithium, and lithium-lead alloys and review of a tritium-solubility model for lithium-lead alloys

By Larsen, E. M.; Ortman, M. S.; Plute, K. E.

From [Report \(1981\)](#), (DOE/ET/52048-18, UWFD-415; Order No. DE81030828), 17 pp.. Language: English, Database: CAPLUS

The projected use of Li-Pb alloys as the T breeding blanket and heat transfer agent in fusion reactors requires data on the soly. of H isotopes in the alloys at the temps. of interest. In the absence of available exptl. data in the desired temp. range, ests. were made on the H isotope soly. in the Li-Pb alloys. In NUWMAK, soly. ests. were based on activity studies of Li in Li-Pb while in WITAMIR the soly. was extrapolated from D measurements in the alloy at higher temps. The existing data and methods of estg. the T soly. in the desired temp. range are discussed.

~0 Citings

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140. The corrosion susceptibility of 2 1/4 chromium-1 molybdenum steel in a lithium-17.6 wt. pct lead liquid

By Anderson, T. L.; Edwards, G. R.

From [Journal of Materials for Energy Systems \(1981\)](#), 2(4), 16-25. Language: English, Database: CAPLUS, DOI:10.1007/BF02833496

Significant penetration at prior austenitic grain boundaries was obsd. in the heat-affected zones of 2 1/4 Cr-1 Mo steel [39362-68-0] gas W-arc welds exposed to 500° for short times to liq. Li contg. 17.6% Pb. Coupons were heat treated to stimulate the coarse-grain bainitic microstructures of the heat-affected zone, and were exposed to Li-17.6%Pb [80493-33-0]. Li corrosion increased with increasing austenitizing temp. and was insensitive to the quenching rate. The penetration kinetics for the corrosion-susceptible microstructures exhibited a change in mechanism assocd. with the conversion of the ϵ -carbide to cementite. The initial penetration mechanism, with an activation energy of 22 kJ/mol, is controlled by C diffusion in liq. Li. The secondary penetration rate exhibited an activation energy of 117 kJ/mol, which suggests that reaction of Li with cementite at grain boundaries is the rate-controlling step.

~0 Citings

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141. Dynamical concentration fluctuations in liquid lithium-lead (Li4Pb)

By Soltwisch, M.; Quitmann, D.; Ruppertsberg, H.; Suck, J. B.

From [Journal de Physique, Colloque \(1980\)](#), (C8), 167-70. Language: English, Database: CAPLUS, DOI:10.1051/jphyscol:1980843

A measurement of the quasielastic neutron scattering from liq. ${}^7\text{Li}_4\text{Pb}$ were performed. Corrections for background, absorption, self shielding, and multiple scattering were applied and the spectra were reduced to cross sections by normalization to V. Since the coherent scattering lengths av. to zero, the intensity obsd. is essentially due to the concn. fluctuation structure factor $S_{cc}(q, E)$. $S_{cc}(q, E)$ Shows a pronounced quasielastic peak around $q \approx 1.5 \text{ \AA}^{-1}$. In the region of the peak, the energy width narrows down by about a factor of 2. A fit in terms of a sum of Lorentzians is attempted which corresponds to an extrapolation of the description valid in the hydrodynamic limit. The self diffusion const. for Li is derived from the ${}^7\text{Li}$ incoherent scattering and an interdiffusion const. from $S_{cc}(q, E)$.

~0 Citings

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142. On the electrical resistivity of the liquid lithium-lead alloy

By Hoshino, Koza; Young, W. H.

From [Journal of Physics F: Metal Physics \(1980\), 10\(7\), L193-L196](#). Language: English, Database: CAPLUS, DOI:10.1088/0305-4608/10/7/003

The behavior of the resistivity of liq. Li-Pb alloys as a function of alloy compn. was explained by a model (1980) in which the formation of mols. is assumed. The neg. temp. coeff. of the resistivity was also discussed qual.

~4 Citings

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143. The reactions of lithium-lead alloys with water

By Finn, P. A.; Clemmer, R. G.; Armstrong, D. R.; Parker, N. E.; Bova, L.

From [Transactions of the American Nuclear Society \(1980\), 34, 55-6](#). Language: English, Database: CAPLUS

A study of the reaction of liq. and solid Li-Pb alloys (potential fusion reactor breeder materials) with water showed that these alloys can react vigorously with water. $\text{Li}_{0.17}\text{Pb}_{0.83}$, having the lowest m.p. of the alloys studied, showed only moderate reaction with water and thus is a potentially attractive candidate for use as a liq. breeding material in water-cooled fusion reactors.

~1 Citing

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144. The activity of lithium, and the solubility of deuterium, in lithium-lead alloys

By Ihle, H. R.; Neubert, A.; Wu, C. H.

From [Comm. Eur. Communities, \[Rep.\] EUR \(1979\), \(EUR 6215, Fusion Technol., Vol. 2\), 639-44](#). Language: English, Database: CAPLUS

The use of Li alloys has been proposed for breeding T in fusion reactor blankets because of the high breeding ratios obtainable. The soly. of T in these alloys is much lower than in Li due to the reduced thermodyn. activity of Li. In view of the particularly high breeding ratio estd. for Li-Pb alloys, and the low induced radioactivity, the system Li-Pb was selected for an exptl. mass spectrometric investigation of the activity of Li in the range $0.95 > x_{\text{Li}} > 0.05$, including Li_7Pb_2 which has the highest m.p. (999 K) of all known phases in this system. Activities were evaluated from vapor pressure measurements at 750, 800, and 850 K. At 750 K, the activity of pure Li is only slightly decreased upon addn. of Pb until the compn. reaches $x_{\text{Li}} = 0.82$ ($\text{Li}_{22}\text{Pb}_5$), where a sharp decrease in Li activity, a_{Li} , down to a value of 2×10^{-2} , is obsd. This value remains const. until a compn. corresponding to $x_{\text{Li}} = 0.72$ is reached, where in a 2nd step the Li activity drops down to 4×10^{-3} . This value of a_{Li} decreases further to 2×10^{-5} at $x_{\text{Li}} = 0.05$. Measurements of the soly. of D in the Li-Pb system showed that at $x_{\text{Li}} \sim 0.78$, corresponding to the solid phase Li_7Pb_2 , the soly. of D is lower by a factor of ~400, compared with that in pure Li at 950 K. In regions where only liq. alloys exist, a continuous decrease of the soly. of D with atom fraction of Li is obsd.

~0 Citings

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145. Thermodynamic study of solid and liquid lithium + lead alloys using Knudsen-effusion mass spectrometry

By Neubert, A.

From [Journal of Chemical Thermodynamics \(1979\), 11\(10\), 971-7](#). Language: English, Database: CAPLUS, DOI:10.1016/0021-9614(79)90046-6

The vapor pressure of Li over samples of liq. and solid $\text{Li}_x\text{Pb}_{1-x}$ alloy ($x = 0.05-0.95$) [73079-74-0] was detd. at 700-900 K using Knudsen-effusion mass spectrometry. The activity of Li and the partial molar enthalpies and entropies were detd. from the results. The molar Gibbs free energy and the molar excess Gibbs free energy were detd. by using the Gibbs-Duhem equation.

~8 Citings

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146. Nucleonic aspects of the LINUS imploding blanket

By Dudziak, Donald J.

From [Proceedings of the Topical Meeting on the Technology of Controlled Nuclear Fusion \(1978\), 3rd.\(1\), 254-61](#). Language: English, Database: CAPLUS

Nucleonic analyses were performed for the Naval Research Lab imploding-liner fusion reactor concept called LINUS. Mixts. of Pb and Li-Pb were used for the liq. metal liner (blanket), with blanket thickness, Li-Pb fraction, and Cd poisoning concn. being varied in scoping studies. Investigated responses were T breeding ratio, n leakage from the liq. liner to permanent reactor structure, and time-dependent nuclear heating of the liner and permanent structure. The T breeding ratio was as high as 1.8 for blankets sufficiently thick (~1 m) to reduce leakage to the permanent structure to tolerable levels. Approx. 98.4% of the energy is deposited in the blanket within 10 μ s, providing confidence that the heating of LINUS's blanket will occur while it is mech. secure.

~0 Citings

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147. Battery with nonaqueous electrolyte

By Jumel, Yves

From [Belg. \(1979\)](#), [BE 873068 A1 19790627](#), Language: French, Database: CAPLUS

A novel battery is described which uses a nonaq. electrolyte, an anode which is Li based, and contains an active material, slightly sol. in the nonaq. solvent. Addnl., the anode surface is thinly layered (to a depth of several hundreds of a mm) and is alloyed with a metal chosen from Pb, Sn, Sb, or Ag, which diffuses with the Li. Thus, the nonaq. solvent can be dioxolane and the active cathode material can be PbO₂ when a Li-Pb [alloy](#) anode is used. A drawing of the special cathode is presented.

~2 Citings

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148. Thermodynamic properties of a quasi-ionic [alloy](#) from electromotive force measurements: the [lithium-lead system](#)

By Saboungi, Marie Louise; Marr, Jane; Blander, Milton

From [Journal of Chemical Physics \(1978\)](#), [68\(4\)](#), [1375-84](#). Language: English, Database: CAPLUS, DOI:10.1063/1.435957

Emf. measurements of the activity of Li in Li-Pb liq. alloys are reported at T = 770-932 K. The partial molar excess Gibbs free energies are neg. Variations with compn. exhibit an inflection point at ~0.2 at. fraction Pb which corresponds to the ratio of the valences of Li and Pb. The inflection point, as well as structural data, may be interpreted by assuming an at least partly ionic character of the [alloy](#). A set of partial structure factors defined by Faber and Ziman (1965) are calcd. as a function of the compn. at the long-wavelength limit. Their variations support the hypothesis of a local short-range order around the above-mentioned compn. (0.2). Finally, a modeling approach based on an electron transfer from Li to Pb is used to explain some of the characteristics of this class of alloys.

~31 Citings

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149. Conditions for the production of [lithium-lead system alloys](#)

By Kiparisov, S. S.; Pedos, S. I.; Fistul, A. D.; Gerardi, N. M.

From [Izvestiya Vysshikh Uchebnykh Zavedenii, Tsvetnaya Metallurgiya \(1976\)](#), [\(5\)](#), [155-7](#). Language: Russian, Database: CAPLUS

Prepn. of LiPb [12372-50-8] and Li7Pb2 [59125-76-7] intermetallic compds. was investigated by vacuum melting at various heating rates, superheating times, and cooling rates. The optimum results were achieved by heating at 5°/min to 350°, holding 15 min after each temp. increase of 50°, and heating 1 h at 600° or 20 min at 800° for prepn. of LiPb and Li7Pb2, resp. The cooling rate was 4-5°/min.

~0 Citings

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150. Short-range order in liquid [lithium-lead alloys](#)

By Ruppertsberg, Henner; Egger, Hans

From [Journal of Chemical Physics \(1975\)](#), [63\(10\)](#), [4095-103](#). Language: English, Database: CAPLUS, DOI:10.1063/1.431179

The neutron diffraction patterns of liq. Li Pb alloys contg. 0, 17, 34, 48, 61, 80, and 100 at.% 7Li were measured. The long-wavelength limit of the partial structure factors $a_{ij}(k)$ and of the concn.-concn. correlation function $Sc_c(k)$ is calcd. These values agree well with the values calcd. from activity data. For the 80 at.% alloy, the total $Sc_c(k)$ function was measured. It shows a pronounced 1st peak at the k value of a prepeak obsd. with x-rays. The Fourier transform of $Sc_c(k)$ is related to the short-range order-size coeffs. which have been introduced by B. E. Warren et al. (1951) to describe the local order of solid solns. The data for the liq. Li-Pb alloys indicate a preference for unlike nearest neighbors and a redn. of the distance between unlike nearest neighbors as compared with the mean distance of the pure components. This short-range order is probably due to a partially saltlike bonding between Li and Pb ions. The over-all structure of the liq. alloys is similar to the structure of a hard sphere system.

~40 Citings

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151. Resonance interferometry of a laser flare on a target from lithium-lead alloy

By Dreiden, G. V.; Ostrovskaya, G. V.; Pobedonostseva, N. A.; Filippov, V. N.

From *Pis'ma v Zhurnal Tekhnicheskoi Fiziki* (1975), 1(2), 106-10. Language: Russian, Database: CAPLUS

The dispersion of neutral atoms in the laser flare plasma on a target of Pb 98 and Li 2% was examd. The concn. of Li atoms was detd. by resonance interferometry. To obtain the resonance interferograms, a dye-based laser with tunable frequency (6400-800 Å) was used to vary within wide limits the sensitivity of Li atom detn. caused by a change of the distance between the probing radiation line and resonance Li doublet. The device consisted of 2 Q-modulated lasers. The beam from a Nd laser (1 J, 30 nsec) was focused on a target placed in a vacuum chamber; energy d. in the focal spot was $\sim 2 \times 10^{10}$ W/cm². The chamber was placed into 1 interferometer arm and transilluminated with ruby and dye-based laser beams. The dye was pumped with the 2nd ruby laser harmonic. By varying the delay between the Nd-laser pulse, forming the flare, and probing the radiation pulse, the different stages of plasma dispersion were studied. The distribution of Li atom concn. in the laser flare within 1-2.3 μ sec is given. At the beginning, the plasma dispersed from the target and then this process was accompanied by the condensation of Li onto the target. During the flare dispersion a shell formed, the Li atom d. in which was higher than in the central flare parts.

~1 Citing

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152. New method for electrolytic polishing and etching of lead and lead alloys

By Verhaege, Marc; De Wilde, Robert

From *Praktische Metallographie* (1973), 10(4), 220-6. Language: German, Database: CAPLUS

The conditions for electrolytic etching of Pb, and alloys of Pb-Li, Pb-Sn-Sb with LiClO₄ in γ -butyrolactone are given. Etched surfaces resist oxidn. for several days. A no. of photomicrographs are presented.

~0 Citings

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153. High-creep-strength lead alloys

By Erdmann-Jesnitzer, Friedrich; Cerjak, Horst

From *Ger.* (1972), DE 1533246 A 19720309, Language: German, Database: CAPLUS

Creep-resistant Pb alloys contg. 0.02-0.04% by wt. Li and 0.001-10 cm³ H/100 g alloy bound as LiH are described. The alloys are suitable for use in cast or wrought form at 80-100° for extended periods as storage-battery plates, cable insulators, or bearings. The alloys are made by adding Li to Pb followed by melting at 400-700°. The melt is then treated with H or H-contg. gases until a sufficient H is incorporated in the alloy and is combined as LiH.

~0 Citings

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154. Lead alloys for accumulators

No Inventor data available

From *Ger. Offen.* (1971), DE 2024351 B2 19750911, Language: German, Database: CAPLUS

An addn. of ~ 0.05 -0.5% Sn to Pb-Li alloys contg. ~ 0.02 -0.03% Li was made. New alloys showed improved workability, they were harder and had higher rupture strength than the Pb-Li alloys. The alloys could be easily cast and were less prone to oxidn. at the grain boundaries.

~0 Citings

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155. Brittleness of two-phase lithium-lead castings

By Wilson, Timothy L.; Mao, Geroge W.

From [Metallurgical Transactions \(1970\)](#), 1, 2631-6. Language: English, Database: CAPLUS

Dil. alloys of Li in Pb were investigated as possible grid alloys for use in Pb-acid batteries. Cast grids can illustrate a time-dependent brittleness assocd. with mold temp. and alloy compn. For temps. above the β to β' Li-Pb transformation, alloys exceeding room temp. solid soly. are initially ductile, whereas samples tend to be brittle at temps. below this transition. The nature of brittleness is discussed and the roles that the transformation occurring in the ppt., coring, and grain boundary pptn. have in promoting brittleness were examd. Pptn. during aging contributes most to the embrittlement by formation of ppt.-free areas in the immediate vicinity of grain boundaries.

~0 Citings

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