

Is γ -Zr a trapping site for hydrogen in zirconium?

In this work experimental evidence, supported by density functional theory modelling, shows that the γ -Zr matrix surrounding second phase particles acts as a trapping site for hydrogen, which has not been previously reported in zirconium.

How does the ingress of hydrogen affect zirconium-based alloys?

The ingress of hydrogen into zirconium-based alloys can have a significant impact on the mechanical behavior of components used in a high temperature aqueous environment, such as light water reactors. Hydrogen is produced in the corrosion reaction, and a significant fraction (depending on the zirconium alloy) is picked up by the metal.

What can hydrides tell us about zirconium?

They can be employed to provide information about hydrogen diffusion in zirconium, thermodynamic and elastic properties of hydrides, interfacial energies between α Zr and hydride phases, as well as some clues as to the formation path of hydrides during precipitation.

Are zirconium alloys safe?

Zirconium alloys are used in safety-critical roles in the nuclear industry and their degradation due to ingress of hydrogen in service is a concern.

What is the concentration of hydrogen in solid solution in zirconium alloys?

The concentration of hydrogen in solid solution in zirconium alloys at the TSS is small: less than 1 wt ppm at room temperature, reaching 65 wt ppm at $\sim 310^\circ\text{C}$, and below 120 wt ppm at maximum operating temperatures, of about 340°C [,,,].

Why is zirconium a brittle hydride?

Due to its high diffusivity and low solubility in zirconium metal, the interstitial hydrogen in zirconium readily migrates under gradients in concentration, temperature and stress, and in sufficient quantities precipitates into a brittle hydride phase.

However, in the commercial field, zirconium-based AB 2 alloy has greater commercial value, and the theoretical discharge capacity reaches 482 mAh g⁻¹, ... The ...

Furthermore, hydrogen can be produced by a variety of non-fossil and fossil resources, making it highly versatile. ... It is difficult to store H₂ since it is a gas at ambient ...

Different from physical hydrogen storage methods such as high-pressure gas cylinders or low-temperature liquefaction, hydrogen storage alloys can store hydrogen in the form of metal hydride by combining with hydrogenation, and ...

can zirconium carbide store hydrogen . Solid state reaction of zirconia with carbon . The solid-solid reaction between zirconia and carbon under flowing argon produces zirconium ...

The zirconium alloy can absorb hydrogen to form Zr hydride which is enhanced by the relaxation of inner stress in the alloy. The hydrogen is generated from an ion/electron ...

A number of transition metals (including titanium, zirconium, and hafnium) can store hydrogen as metal hydrides for use as fuel in hydrogen powered vehicles 1st attempt dal See Periodic ...

Metals may absorb hydrogen during its operation due to interaction with the ambient environment in various industrial applications (e.g. as a secondary product of ...

Metal borohydride (MBH₄) compounds have been studied thoroughly for their potential as hydrogen storage materials. Zirconium borohydrides are one such class of metal ...

The hydrogen (H₂) storage capacity of Zirconium (Zr) decorated zeolite templated carbon (ZTC) has been investigated using sophisticated density functional theory (DFT) ...

Efficient hydrogen storage performance ensures that getters can hold large amounts of hydrogen isotopes and release them as needed, thus enhancing the overall cycle ...

In this work experimental evidence, supported by density functional theory modelling, shows that the β -Zr matrix surrounding second phase particles acts as a trapping ...

Can zirconium carbide store hydrogen What can hydrides tell us about zirconium? They can be employed to provide information about hydrogen diffusion in zirconium, thermodynamic and ...

to hydrogen, except possibly at very high hydrogen pressures.²⁹ However, recent investigations have demonstrated that these alloys can be severely degraded by exposure to ...

Because hydrogen ingress into zirconium cladding can cause embrittlement and limit cladding lifetime, hydrogen pickup during corrosion is a critical life-limiting degradation mechanism for ...

Ti-V-Cr Body Centred Cubic (BCC) solid solutions can form hydrides of relatively high capacity which store hydrogen at room temperature under low hydrogen pressure [1], [2], ...

To help gain insight, molecular dynamics simulations have been employed to investigate hydrogen isotope population in zirconium containing different types of edge dislocations. Our studies reveal that hydrogen isotope ...

The ingress of hydrogen into zirconium-based alloys can have a significant impact on the mechanical behavior of components used in a high temperature aqueous environment, ...

We predict that each Zr atom decorated on graphyne sheet (2D) can adsorb up to seven H₂ molecules with an average adsorption energy of -0.44 eV/H₂, leading to a hydrogen ...

The data on hydrogen behavior in zirconium have been systematized. The proposed study deals with a number of basic physicochemical characteristics of the two participants in the Zr-H (H and Zr ...

Hydrogen has a strong potential for use as an alternative fuel provided that it can be stored in a safe and efficient way. One possibility is to store hydrogen as a solid hydride ...

Zirconium. 1. Introduction. The concept of energy is a current issue that is increasingly important in our lives. With the increase in human population and needs, the ...

Materials that can store hydrogen in the solid state and release it in situ when needed are therefore an attractive solution because they remove the need to transport and store gaseous ...

Sustainable development of hydrogen energy is a prime concern to address the rising energy demand and the global energy problem since the hydrogen economy is reliable for clean and carbon-free ...

A plethora of studies have been geared towards enhancing the adsorption interaction (to the recommended 15-20 kJ mol⁻¹ [35] between hydrogen and the frameworks ...

Sustainable development of hydrogen energy is a prime concern to address the rising energy demand and the global energy problem since the hydrogen eco...

However, the small database in [8] prevents any dependence on time of the hydrogen concentration in the zirconium alloys from being deduced. In [9], steam oxidation of ...

The mechanism can be categorised as hydrogen environmental embrittlement, internal hydrogen embrittlement and hydrogen reaction embrittlement [66]. The hydrogen ...

In this study, we investigate the effect of small amounts of zirconium alloying the medium-entropy alloy (TiVNb)₈₅Cr₁₅, a promising material for hydrogen storage. Alloys with 1, 4, and 7 at.% of Zr were prepared by arc ...

To run a sustainable society, hydrogen is considered as one of the most reliable option for clean and carbon free energy carrier. Hydrogen can be prod...

The dissolution of oxide layer leads to the formation of micro-cracks in the oxide layer which shorten the path

of movement for both oxygen and hydrogen as well as promote a ...

Solid-state hydrogen storage in metal hydrides and complex hydrides occurs via chemisorption, hindering the process's reversibility and preventing desorption [5, 8]. For ...

hydrogen binding energies of -0.1 to -0.15 eV are designed and synthesized. The HEAs reversibly store hydrogen in the form of Laves phase hydrides at room temperature, ...

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