

Since the first two methods of hydrogen storage involve high pressure and low temperature, energy consumption is greatly increased, and safety is low [[12], [13], [14]]. In contrast, solid-state storage is considered to be the most promising hydrogen storage method owing to its higher hydrogen storage efficiency, energy density, and safety [15 ...

Storage in the form of liquid hydrogen: In liquid form, hydrogen needs to be stored at  $\sim 20$  K and 1 bar. However, maintaining such low temperature is very energy intensive and expensive too and there will be continuous boil off losses from the cryogenic hydrogen storage system (approximately 0.3-3% volume/day, depending on size/capacity) to the ...

For hydrogen to become a viable energy carrier advanced hydrogen storage system will be required. More compact, low weight, low cost, safe, ... BCC, C-14, and C-15 laves and hexagonal close-packed (HCP) are favored for hydrogen storage alloy. Therefore the prediction of a particular phase for the selected HEA became important in regards to the ...

Storage of hydrogen in solid-state materials offers a safer and compacter way compared to compressed and liquid hydrogen. Vanadium (V)-based alloys attract wide attention, owing to the total hydrogen storage capacity of 3.8 wt% and reversible capacity above 2.0 wt% at ambient conditions, surpassing the AB<sub>5</sub>-, AB<sub>2</sub>- and AB-type hydrogen storage alloys. ...

A 2 B type magnesium series hydrogen storage alloy, Mg<sub>2</sub>Ni, is regarded as one of the most promising hydrogen storage materials in the twenty-first century since it has a high hydrogen storage ...

Unusually for metal hydrides with a high hydrogen storage capacity, the alloy goes through successive stages of dehydrogenation without a phase transition, preserving the FCC structure (imitating the Ce-H system). ...

Intermetallic alloys such as FeTi have attracted ever-growing attention as a safe and efficient hydrogen storage medium. However, the utilization of high-purity metals for the synthesis of such ...

Developing safer and more efficient hydrogen storage technology is a pivotal step to realizing the hydrogen economy. Owing to the lightweight, high hydrogen storage density and abundant reserves, MgH<sub>2</sub> has been widely studied as one of the most promising solid-state hydrogen storage materials. However, defects such as stable thermodynamics, sluggish ...

Ti-Mn hydrogen storage alloys have the characteristics of relatively high hydrogen storage capacity, easy activation, fast hydrogen absorption and desorption rate, wide adjustable range of hydrogen absorption and

desorption ...

The research on the functional properties of medium- and high-entropy alloys (MEAs and HEAs) has been in the spotlight recently. Many significant discoveries have been made lately in hydrogen-based economy ...

where  $P_{eq}$  is the equilibrium hydrogen pressure,  $\Delta H$  and  $\Delta S$  are the enthalpy and entropy changes in the hydride formation reaction, respectively,  $R$  is the gas constant, and  $T$  is the absolute temperature.. As illustrated in Figure 1a, the thermodynamic conditions for hydrogen storage in metals depend on their plateau pressure or equilibrium pressure, determined by ...

2.2 Crystal structure of Ti-Mn-based hydrogen storage alloy hydrides. AB<sub>2</sub> type Laves phase alloys are intermetallic compounds, where the atomic diameter ratio of A metal (Ti, Zr, etc.) to B metal is 1.255, or a series of alloys with dense filled structures is approximately this value. In the Laves phase, the metal is densely aggregated and has three structures, C14 ...

Nanomaterials have revolutionized the battery industry by enhancing energy storage capacities and charging speeds, and their application in hydrogen (H<sub>2</sub>) storage likewise holds strong potential, though with distinct challenges and mechanisms. H<sub>2</sub> is a crucial future zero-carbon energy vector given its high gravimetric energy density, which far exceeds that of ...

Hydrogen is emerging as a key energy carrier as the world moves towards cleaner and sustainable energy sources [1, 2]. High energy density and a minimal environmental impact make it a clean and viable option for power generation, transportation, energy storage, and other uses [3]. Identifying appropriate materials for safe and efficient hydrogen storage is of ...

Multi-component alloys involve the deliberate combination of elements to form solid solutions or intermetallic compounds, aiming to achieve enhanced hydrogen storage properties [17], [18] More recently, there has been a growing exploration of HEAs, a novel class of alloys under investigation for hydrogen storage that exhibits the capability to ...

Solid-state hydrogen storage is a significant branch in the field of hydrogen storage [[28], [29], [30]]. Solid-state hydrogen storage materials demonstrate excellent hydrogen storage capacity, high energy conversion efficiency, outstanding safety, and good reversibility, presenting a promising prospect and a bright future for the commercial operation of hydrogen energy [[31], ...

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