

Using hydride forming materials for hydrogen compression, capture and/or purification

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Hydride forming materials (HFM) are mainly studied for hydrogen storage and batteries applications, but their affinity with hydrogen suggest they could be used for hydrogen purification, capture or separation from mixed gaseous sources. Moreover, the dependence of the equilibrium pressure of the hydriding reaction with temperature allows the design of hydrogen compressors without mobile parts.

The properties of known HFM are suitable enough to design now solutions for some technological problems. In particular, AB5 alloys are good candidates for this purpose, as they have high volumetric storage capacity, show fast reaction kinetics with hydrogen and can be tailored to react with hydrogen at a given pressure and temperature. In this work we present some applications of AB5 alloys to hydrogen compression, capture and purification we developed in our laboratory.

The high volumetric storage capacity and tailoring properties of the AB5 HFM allow us to design an avalanche control equipment based on hydrogen-oxygen explosive combustion. Hydrogen low pressure storage and non contaminant product of explosions (humidity) are advantages when compared with other control methods.

Taking advantage of the dependence of equilibrium pressure with temperature we set up a hydrogen compressor to store the ultra pure hydrogen produced at 5 bar by an electrolysis process up to 60 bar in a standard bottle.

Using the selectivity of the reaction of HFM with hydrogen we are designing solutions for hydrogen capture and hydrogen purification to solve problems of our local industry. In both cases hydrogen is mixed with impurities (CO, CO₂, N₂, humidity and/or inert gases) at a total pressure lower than 1 bar. We will present some results obtained with scaled prototypes working under real conditions.