MECHANOCHEMICAL DESTABILIZATION OF MgH_2-V NANOCOMPOSITES FOR HYDROGEN STORAGE

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Abstract

In light of the growing need and necessity for decarbonization, hydrogen plays a decisive role. If hydrogen is aimed to be used as a fuel, the challenges of the low cost of production and safe storage of hydrogen must be overcome. In the current storage methods, hydrogen is compressed under pressure up to 700 bar or liquefied at cryogenic temperatures, i.e., cooling to 20 K (-253,15 ºC), meaning high costs and unsafe storage. Therefore, solid-state storage, using primarily metal hydrides, especially light metal hydrides, is a promising solution because it offers safe handling in stationary or mobile applications, as well as higher gravimetric hydrogen capacity. Considering the strong chemical bond between hydrogen and metals in these compounds, which in turn leads to slow kinetics and high dehydration temperatures, the effect of destabilization of the magnesium hydride structure using vanadium as an additive and the method of mechanical milling in a high energy ball mill was examined. The influence on the morphological and microstructural changes in structure was monitored by X-ray diffraction, scanning electron microscopy, particle size analysis and Fourier transform infrared spectroscopy attenuated total reflection. The observed changes were associated with the changes in dehydration temperature and the desorption kinetics of hydrogen followed by DSC analysis. A significant improvement in the performance of the tested material after the applied destabilization methods concerning pure magnesium hydride can be noticed.

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