Investigation of the first hydrogenation of $LaNi_5$ and TiFe metal hydrides

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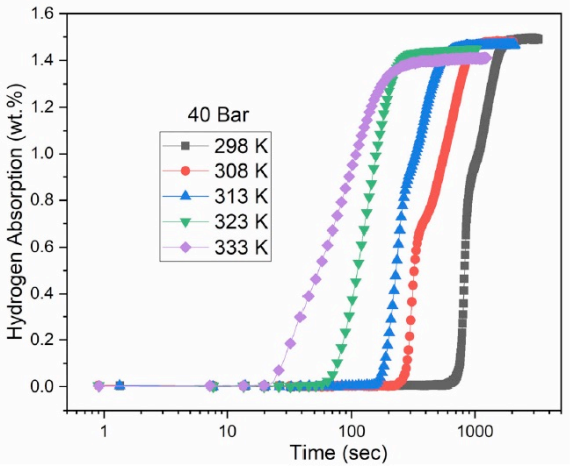
Abstract

Metal hydrides are considered to be a safe and efficient way to store hydrogen at low pressure and room temperature. However, there are a number of issues to be solved, such as low gravimetric capacity, reversibility and cost. Regarding the cost issue, one of the problems is that the first hydrogenation is usually slow and necessitates high temperature and pressure. This, in turn, significantly increases the production cost of metal hydrides. In this we will present our recent investigation of the first hydrogenation of two well-known metal hydrides: the low temperature $LaNi_5$ alloy and the TiFe alloy. For both alloys, we found that the first hydrogenation follows an Arrhenius process. The activation energy and pre-exponential factors were measured. From measurements at constant temperature and different pressures, it was found that the pre-exponential factor is pressure dependent. The effect of particle size was also investigated. With the establishment of a functional form for the first hydrogenation, a better understanding of the mechanism was achieved.



Recent Publications

1. Sleiman, S.; Huot, J. Microstructure and First Hydrogenation Properties of TiHfZrNb1-xV1+x Alloy for x = 0, 0.1, 0.2, 0.4, 0.6 and 1. Molecules 2022, 27, 1054.
2. Kefi, C.; Huot, J. Microstructure and First Hydrogenation Properties of Ti30V60Mn(10−x)Crx (x = 0, 3.3, 6.6, 10) + 4 wt.% Zr. Metals 2023, 13, doi:10.3390/met13061119.
3. Ravalison, F.; Huot, J. Hydrogenation Thermodynamics of Ti16V60Cr24−xFex Alloys (x = 0, 4, 8, 12, 16, 20, 24). Hydrogen 2024, 5, 29-38.
4. Sleiman, S.; Shahgaldi, S.; Huot, J. Investigation of the First Hydrogenation of LaNi5. Reactions 2024, 5, 419-428.

Biography

Author has expertise in solid-gaz interactions, metal hydrides, and material characterization. He has a Ph.D. in Physics from Laval University. He was a postdoc at the Chemical Engineering Department of Texas A & M University and also at the National Institute of Materials and Chemical Research in Japan. From 1995 to 2004, he was a researcher at Hydro-Québec where he studied magnesium-based nanocrystalline alloys for hydrogen storage. Since 2004 he is a professor at UQTR and a member of HRI. He published more than 240 papers and is a co-inventor of 10 patents. His H-index is 57 on Scopus. In 2018 he received the prize of achievement in research from the Université du Québec à Trois-Rivières.

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