# Use of Non-aqueous Electrochemical Cells to Investigate Air- and Water-Sensitive Hydrogen Storage Materials

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There is continuous interest in materials that have high specific capacities for the storage of hydrogen. A number of materials are currently used as reversible hydrogen storage electrodes in small electrochemical cells. They typically have large capacity densities, i.e., capacities per unit volume, but are too heavy to be considered for larger scale applications in which weight is an important parameter. Cost can also be a significant problem, as well.

One of the directions that seems to be attractive would be to use metal hydride systems containing magnesium, for this element is relatively inexpensive and has a low weight. However, the affinity of magnesium for oxygen and water is very high. This means that magnesium-containing materials can be easily poisoned by even minor amounts of such species, and results in practical difficulties when the hydrogen is present in the gas phase. Direct contact with aqueous electrolytes in electrochemical systems is also obviously out of the question with such materials.

There are two ways to get around such problems in electrochemical systems. One is to have an electrolyte that is in true thermodynamic equilibrium with the species in the electrode, so that there is no driving force for the formation of a reaction product on the surface. The other is to arrange the thermodynamic conditions at the interface such that a reaction product is formed that is a good solid electrolyte for the electroactive species.

It has been shown that there are several molten salts with relatively low melting points that are thermodynamically stable in contact with alkali metals. They can be used as hydrogen-conducting electrolytes if they contain hydride ions. Using the alkali metal as a secondary reference leads to the opportunity to perform electrochemical experiments to determine the hydrogen storage properties of materials containing highly reactive materials such as magnesium. Such experiments can provide analogous information that that which is obtained from conventional pressure-capacity-temperature experiments in metal hydride systems.

Experimental results on materials in the Mg-Al, Mg-Cu and Mg-Ni systems will be presented.