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Metal hydrides (MH_x)

Properties

Hydrogen, the lightest of the chemical elements, forms compounds (hydrides) with all elements except inert gasses. Metal hydrides are a class of materials containing metal or metalloid bonded to hydrogen. Most transition metals form hydride complexes. As the electronegativity of the host metal increases, the metal hydrogen bond becomes more metallic in nature, and the resulting hydride is more metal-like in its properties. In terms of conductivity, metal hydrides containing alkali (Group 1a) or alkaline earth metals (Group 2a) with low EN are not likely to accept electrons from hydrogen. These metal hydrides form ionic solids with a very negative heat of formation that are stable and do not conduct electricity.

Plating Solutions

Copper hydride can be deposited galvanostatically at room temperature in an aqueous bath containing 1.25 M $CuSO_4$, 0.1 M H_2SO_4, and 36 mg/L thiourea with a current density of 500 mA/cm^2 with presence of a permanent magnet with a surface magnetization of 0.5 T [1]. It is induced by enhanced hydrogen evolution as a result of magnetohydrodynamic flow, i.e. increased mass transport of H+ ions as promoted by the magnetic field.

Nickel hydride can be made by depositing Ni from an electrolyte containing $NiSO_4$, $NiCl_2$, H_3BO_3, saccharine, and 2-butyn-1,4-diol, and subsequently hydrogenating using a hydrogenation-enhancing additive like H_2SeO_3 [2].

Applications

Metal hydrides can be used in many different applications due to its numerous unique properties especially reversible hydrogen storage capability and high reaction heat. They have various applications in Solid Hydrogen Storage, NiMH Secondary Batteries, Purifying Hydrogen, Heat generators, and Nuclear Applications [3]. They also have chemically active metal surface that makes them perfect candidates for Chemical Catalysts.

References:

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[2] M. Monev. *Electrochim. Acta* **46** (15), 2373–2378, 2001.
[3] K. Young, "Metal Hydrides," *Ref. Modul. Chem. Mol. Sci. Chem. Eng.*, Jan. 2018.

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