

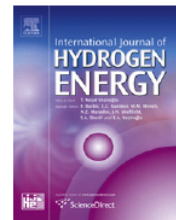


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The effects of nanonickel additive on the decomposition of complex metal hydride LiAlH_4 (lithium alanate)

Robert A. Varin^{a,*}, Leszek Zbroniec^a, Tomasz Czujko^b, Zbigniew S. Wronski^{a,b}

^aDepartment of Mechanical and Mechatronics Engineering, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1

^bCanmetENERGY, Hydrogen Fuel Cells and Transportation Energy, Natural Resources Canada, 1 Haanel Dr., Ottawa, Ontario, Canada K1A 1M1

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ABSTRACT

High energy ball milling up to at least 1h does not lead to the transformation of undoped LiAlH_4 as well as LiAlH_4 doped with n-Ni into Li_3AlH_6 . In a DSC test the melting of LiAlH_4 is completely eliminated by the addition of 5 wt% n-Ni incorporated by high energy ball milling. The $\text{LiAlH}_4 + 5$ wt% n-Ni system processed by ball milling desorbs ~ 4.8 wt% H_2 at 120 °C within 2000 s. At 120 °C within a 5000 s time interval the desorption reaction occurs fully in a solid state in one step according to the following reaction: $\text{LiAlH}_4 \rightarrow 1/3\text{Li}_3\text{AlH}_6 + 2/3\text{Al} + \text{H}_2$. This reaction is completely non-volatile. At 140 °C and higher temperatures the desorption reaction of ball milled $\text{LiAlH}_4 + 5$ wt% n-Ni occurs fully in a solid state most likely in two steps according to the following reactions: (1) $\text{LiAlH}_4 \rightarrow 1/3\text{Li}_3\text{AlH}_6 + 2/3\text{Al} + \text{H}_2$ and (2) $1/3\text{Li}_3\text{AlH}_6 \rightarrow \text{LiH} + 1/3\text{Al} + 0.5\text{H}_2$. However, XRD patterns after reaction (2) do not show the presence of LiH but instead, they show the presence of LiOH. It is possible that LiH is transformed rapidly into LiOH by a mechanism which is now under investigation. When stored for a long time at room temperature the heavily ball milled $\text{LiAlH}_4 + 5$ wt% n-Ni system gradually degrades losing H_2 capacity.

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