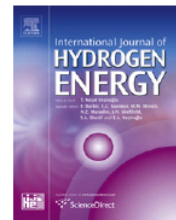




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## The effects of nanonickel additive on the decomposition of complex metal hydride $\text{LiAlH}_4$ (lithium alanate)

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### ABSTRACT

High energy ball milling up to at least 1h does not lead to the transformation of undoped  $\text{LiAlH}_4$  as well as  $\text{LiAlH}_4$  doped with n-Ni into  $\text{Li}_3\text{AlH}_6$ . In a DSC test the melting of  $\text{LiAlH}_4$  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  $\sim 4.8$  wt%  $\text{H}_2$  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  $\text{H}_2$  capacity.

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