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Improved Hydrogen Sorption Kinetics of Compacted $LiNH_2$-LiH Based Small Hydrogen Storage Tank by Doping with TiF_4 and MWCNTs

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Abstract : Hydrogen storage tank containing compacted LiNH2-LiH is developed by doping with TiF_4 and multi-walled nanotubes (MWCNTs) to study kinetic properties. Transition metal-based catalyst (TiF_4) provides the catalytic effect on hydrogen dissociation/recombination, while MWCNTs benefit thermal conductivity and hydrogen permeability during de/rehydrogenation process. The Enhancement of dehydrogenation kinetics is observed from the single-step reaction at a narrower and lower temperature range of 150-350 ºC (100 ºC lower than the compacted $LiNH_2$-LiH without additives) as well as long plateau temperature and constant hydrogen flow rate (50 SCCM) up to 30 min during desorption. Besides, Hydrogen contents de/absorbed during 5-6 cycles increase from 1.90-2.40 to 3.10-4.70 wt. % H_2 (from 29 to up to 80 % of theoretical capacity). In the process, Li_5TiN_3 is detected upon cycling probably absorbs NH_3 to form $Li_5TiN_3(NH_3)x$, which is favoring hydrogen sorption properties of the $LiNH_2$-LiH system. Importantly, the homogeneous reaction mechanisms and performances are found at all positions inside the tank of compacted $LiNH_2$-LiH doped with TiF_4 and MWCNTs.

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