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Kinetic Enhancement of Hydrogen Cycling in $NaAlH_4$ by Melt Infusion into Nanoporous Carbon Aerogel FREDERICK PINKERTON, ROBERT STEPHENS, GM Research and Development Center, ADAM GROSS, SKY VAN ATTA, JOHN VAJO, HRL Laboratories, LLC — Enhanced kinetic performance and reversibility have been achieved with uncatalyzed $NaAlH_4$ by incorporation into nanoporous carbon aerogel. Aerogel with a pore size distribution peaked at 13 nm and a pore volume of 0.8 cm^3/g was filled with $NaAlH_4$ to 94% capacity by melt-infusion at 189 C under 183 bar H_2 gas overpressure. Dehydrogenation to NaH + Al with reasonable kinetics was accomplished at 150 C, well below the $NaAlH_4$ melting temperature (183 C), compared to hydrogen release above 230 C for bulk uncatalyzed $NaAlH_4$. Uncatalyzed bulk samples did not rehydrogenate under laboratory conditions, whereas $NaAlH_4$ in a carbon aerogel host was readily rehydrogenated at $\sim$160 C and 100 bar H_2 to $\sim$85% of its initial capacity. Ball-milled $NaAlH_4$ catalyzed with 4 mol% $TiCl_3$ showed somewhat better kinetics compared to the infused aerogel; nevertheless, the large kinetic enhancement obtained by incorporation into carbon aerogel, even in the absence of a catalyst, demonstrates the substantial benefit of confining the $NaAlH_4$ to nanoscale dimensions.

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