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Reversible Low Temperature Hydrogen Storage Using Ternary Borides WEN LI, JOHN VAJO, ROBERT CUMBERLAND, PING LIU, HRL Laboratories, LLC, SON-JONG HWANG, CHUL KIM, California Institute of Technology, ROBERT BOWMAN, RCB Hydrides, LLC — Among many materials for hydrogen storage, complex borohydride of light metals with high hydrogen capacity, have been studied extensively. However, the thermodynamic and kinetic properties of borohydrides limit their ability to cycle hydrogen reversibly at low temperature. For example, although $LiBH_4$ is thermodynamically quite stable, the formation of $LiBH_4$ from LiH + B requires elevated temperatures and pressures of up to 600 $^\circ$C and 150 bar. Here, we report ternary borides with active boron species that can be hydrogenated forming $[BH_4]^-$ anions at temperatures as low as $\sim$280 $^\circ$C. These ternary borides were prepared through milling of precursors followed by thermal treatment under inert atmosphere. Samples were then milled with additional binary hydrides before hydrogenation. Analysis using FTIR and ^{11}B MAS NMR indicated that the ternary borides were hydrogenated to $[BH_4]^-$ species with good kinetics. After hydrogenation, the mixture could be cycled with dehydrogenation occurring in two steps that begin at 280 $^\circ$C and 345 $^\circ$C, respectively. Characterization using FTIR, ^{11}B MAS NMR, and XRD, indicates that the $[BH_4]^-$ anions are consumed in the first dehydrogenation step.

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