Enhanced Thermolytic Dehydrogenation of Ammonia Borane Complexes for Hydrogen Storage in Mobile Applications

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This work addresses enhanced dehydrogenation of ammonia borane (AB) and polyamino borane (PAB) when exposed to gaseous CO2 environments. AB (NH3BH3) is one of attractive hydrogen storage materials, because it contains 19.6 wt. % hydrogen and is light. The AB thermolysis has three stages occurring around 110, 150, and > 1200 oC with respective 6.5 wt. % of hydrogen release. Slow hydrogen release at temperatures around 85 oC makes pristine AB infeasible as an on-board hydrogen storage medium. To enhance the dehydrogenation kinetics, dispersing AB in various materials and adding transition metal catalysts have been proposed. However, these approaches cause to adversely affect storage density and cost. Thus, the research has pursued to identify more effective promoters for hydrogen release. This talk will describe a new method of promoting hydrogen release using CO2 treatments of AB and PAB and report higher than 11 wt% hydrogen release at 85 oC starting from fresh AB, which can fulfill the 5.5 wt% DOE target. Fundamental mechanisms will be discussed by using various analytic techniques.