Hydrogen production through thermal degradation of confined systems

The development of highly efficient materials for chemical hydrogen storage is one of the great challenges for driving the hydrogen economy to a major breakthrough. The safety of hydrogen tanks and the energy required for compression to high pressure have drastically slowed down the spread of the hydrogen-based mobility. Several alternatives have been proposed to overcome these problems using inorganic or organic carriers. Among all the available species, ammonia borane (AB) is one of the most interesting compounds with a theoretical gravimetric hydrogen storage capacity of up to 19.6 wt %. The most challenging and attractive AB dehydrogenation route is the solid state thermal-induced dehydrogenation. Nevertheless, this reaction is complex, involves several pathways and mechanisms that could be promoted or suppressed by the presence of additives. The solid-state dehydrogenation kinetic of AB under thermal stimuli is widely investigated by directly mixing AB with dehydrogenation catalysts or by confinement into a porous matrix .

Nevertheless, an interesting process to tune the AB systems is the preparation on an unstable confined AB with a tuned the degradative pathways by adding a chemical species such as high boiling point amine reporting a hydrogen storage capability up to 10 wt.%.