

Abstract

In this work the hydrogen storage properties of ethylene diamine bisborane (EDB) and hydrazine bisborane (HBB) in ionic liquids (ILs) were evaluated. It has been shown that the addition of ILs drastically improves liberation rate and hydrogen yield from thermal dehydrogenation of the storage materials. The most successful ILs for hydrogen liberation from EDB were 1-butyl-3-methylimidazolium chloride respectively acetate and 1-butyl-2,3-dimethylimidazolium chloride ([BMMIM]Cl) respectively acetate. A qualitative correlation between the basicity of the anion of the IL and hydrogen yield was found. The application of one of the mentioned ILs raises the hydrogen yield up to 60% in comparison to neat EDB. The addition of metal salt catalysts precursors has a rather small influence on hydrogen liberation, though at lower temperatures the amount of evolved hydrogen rises distinctly. Similar findings hold true for HBB: The addition of certain ILs, e.g. [BMMIM]Cl, accelerates hydrogen liberation from HBB, which is rather slow from the pure material. Reaction times of 17 h can be reduced to less than 2 h by addition of [BMMIM]Cl. The addition of metal salts does not affect the decomposition strongly. Since the mechanism of EDB dehydrogenation is not completely clear yet, some investigations on the nature of the polymeric by-products have been made. In mass-spectrometric analysis several polymeric species were found and possible structures were suggested. In the last part of this work the hydrogen liberation from EDB was employed for transfer hydrogenation reactions. EDB can be used for the selective hydrogenation of carbonyl groups. If a catalyst is employed, transfer hydrogenations of other substrates are possible: alkenes and alkynes can readily and selectively be hydrogenated using Ru or Pd nanoparticle catalysts in IL as catalysts and EDB as hydrogen source.