



## The McGill-Montreal Chapter

Sigma Xi :: The Scientific Research Society ::



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### **PUBLIC LECTURE**

#### **When:**

**Monday**

**October 26th 2009**

**6 P.M.**

#### **Where:**

McGill University  
Otto Maass Chemistry  
Building  
Room 10

## **Sigma Xi - Public Lecture**

# **Hydrogen storage options for long-haul transportation:**

## **Can amine-boranes pull their own weight?**

The use of hydrogen as an energy carrier offers a clean alternative to current combustion of fossil fuels that produces harmful carbon particulates, oxides of nitrogen and sulfur, and voluminous quantities of carbon dioxide. As others work on efficient production of hydrogen from water and sunlight, we are investigating options for on-board hydrogen storage to enable long-haul transportation that is key to moving goods across North America. While metal hydrides and metal organic framework sorbents provide reversible storage options, they are currently unable to meet the storage capacity requirements for long-haul transportation. So-called "chemical hydrides" such as azacycloalkanes can also serve as reversible hydrogen storage media, but activation barriers are high and dehydrogenation rates remain slow with the best catalysts.

With both protic N-H and hydridic B-H bonds as well as three hydrogen atoms per main group element, ammonia-borane (AB,  $\text{H}_3\text{NBH}_3$ ) is a promising material for high capacity hydrogen storage applications.<sup>1</sup> Detailed studies of the dehydro-oligomerization of AB has revealed a wealth of reaction products and reaction pathways depending on reaction media and conditions, additives and catalysts. Through detailed in situ NMR studies of AB dehydrogenation using a variety of catalyst precursors we have identified a key reaction intermediate proposed to arise by trapping of reactive aminoborane monomer,  $\text{H}_2\text{NBH}_2$ , by AB.<sup>2</sup> A new family of chelating diamine bis(phosphine) iron catalysts is proposed to dehydrogenate amine-boranes via a Noyori-type heterolytic activation mechanism.<sup>3</sup> Finally, remaining technical barriers to commercialization of amine-borane fuels will be described.

<sup>1</sup> Stephens, F. H.; Pons, V.; Baker, R. T. *Dalton Trans.* **2007**, 2613; Marder, T. B. *Angew. Chem. Int. Ed.* **2007**, *46*, 8116; Hamilton, C. H.; Baker, R. T.; Staubitz, A.; Manners, I. *Chem. Soc. Rev.* **2009**, *38*, 279.

<sup>2</sup> Pons, V.; Baker, R. T.; Szymczak, N. K.; Heldebrant, D. J.; Linehan, J. C.; Matus, M. H.; Grant, D. J.; Dixon, D. A. *Chem. Commun.* **2008**, 6597.

<sup>3</sup> Blaquiere, N.; Diallo-Garcia, S.; Gorelsky, S. I.; Black, D. A.; Fagnou, K. *J. Am. Chem. Soc.* **2008**, *130*, 14034; Kass, M.; Friedrich, A.; Drees, M.; Schneider, S. *Angew. Chem. Int. Ed.* **2009**, *48*, 905.

**Preceded by a members-only reception  
5:30 P.M.**

**Ruttan Room**



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