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Selected Publications


TRANSITION METAL BORON CHEMISTRY

I am interested in the synthetic, structural and reactivity investigations of transition metal boron multiple bonded systems. The first project involves the development of N-heterocyclic borylene systems, NHB (analogous to well known NHC) that act as ligands in different transition metal complexes. We believe the first step in achieving this goal is to first synthesize relatively unknown cationic tri-coordinate haloborane compounds 2, from their well-developed dihalo-precursors 1, and to engage them with different transition metal moieties in oxidative additions and salt elimination reactions.

\[
\begin{array}{c}
\text{N} \\
\text{B} \\
\text{X}
\end{array} \rightarrow \begin{array}{c}
\text{N} \\
\text{B} = \text{M}_n
\end{array} \rightarrow \begin{array}{c}
\text{N} \\
\text{B} = \text{M}_n
\end{array}
\]

\[
\text{X} = \text{NacNac, amidinate, guanidinate, etc.}
\]

The second part of this research is focused on developing the synthetic strategies towards the isolation of the first examples of transition metal complexes containing a triple-bonded boron ligand i.e. borylidyne. Again, the development of tri coordinate dihaloborane cations 4 stabilized by a Lewis base (e.g. carbene, phosphine etc) will be crucial for this project by halide abstraction from their well-developed precursors 3. These unknown compounds 4 will then be subjected to different transition metal moieties in order to synthesize the targeted complexes.

\[
\begin{array}{c}
\text{L} \\
\text{B} = \text{M}_n
\end{array} \rightarrow \begin{array}{c}
\text{L} \\
\text{B} = \text{M}_n
\end{array} \rightarrow \begin{array}{c}
\text{L} \\
\text{B} = \text{M}_n
\end{array}
\]

NEW GENERATION OF LEWIS ACIDS

We are very interested in developing very reactive Lewis acids. The scientific literature praises the use of different triflate (OTf) containing reagents but very little has been done to combine triflates and ligands. Thus our goal is to develop bistriflate and cationic monotriflate Lewis acids based on group 13 elements. Also, replacing triflate ligands with a sterically demanding neutral ligand (carbene, phosphine etc) to generate coordinatively unsaturated dicaticion species is one of our biggest challenges. These dicaticion complexes are predicted to be extremely reactive and our goal is to try to employ them in sequestering green house gas CO₂.

\[
\begin{array}{c}
\text{R} \\
\text{E}
\end{array} \rightarrow \begin{array}{c}
\text{OTf}
\end{array} \rightarrow \begin{array}{c}
\text{OTf}
\end{array} \rightarrow \begin{array}{c}
\text{OTf}
\end{array}
\]

\[
\text{R = terphenyl, bis(mimino)aryl, NacNac, amidinate, etc}
\]

\[
\text{L = carbene, phosphine, etc}
\]

SITE-SPECIFIC DEUTERATION OF FATTY ACIDS

Preliminary experimental results show that site-specific deuterated polyunsaturated fatty acids (PUFA), such as linoleic and linolenic acids, are more resistant to oxidative stress, which is thought to be one of the leading causes of aging and age related diseases, than their non-deuterated analogues. Thus, this project explores catalytic H/D exchange (deuteration) of bisallylic positions PUFA as the total synthesis of the targeted molecules is too expensive. This is a collaborative project with Retrotope, Inc.