Exploring Tunable Dynamic Catalysis using Alkali Metal Salts

Stewart Kerr, B.S. Chemistry, B.A. Mathematics
Professor Alexander Miller, UNC Chemistry Dept.
Background

*Tunable dynamic catalysis using cations*

My project is to develop an understanding of cation-crown ether interactions in our nickel compound. How can we maximize the catalytic nature of the nickel compound just by adding different salts to it? Traditional catalytic research involves synthesizing a new catalyst for each study – this requires a lot of time and money – however, if we can control catalysis by just adding salts to the catalyst, we can save significant time and money in going and future research.

Binding cations (positively charged ions) in the pincer-crown ether ligand (in blue) opens up a site on the metal (Ni) for catalysis to occur.
Results

Cation binding depends on the crown ether, for our sized crown ether lithium binds most strongly (Li⁺ > Na⁺ = K⁺)

- We found that for our nickel complex, Li⁺ binds about 10 times stronger than Na⁺ and K⁺
- Also, cation interaction with our nickel complexes depends on the size of the crown ether
- These results will allow us to more easily and rationally tune our catalysts, using Li⁺, in future research
- This is the first step in developing cheaper catalysts that can be more easily controlled to synthesize plastics, medicines, and other consumer products

<table>
<thead>
<tr>
<th>Salt</th>
<th>LiPF₆</th>
<th>LiOTf</th>
<th>NaBArF</th>
<th>KPF₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kₑq (M⁻¹)</td>
<td>101</td>
<td>71</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
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A larger Kₑq means a stronger interaction between the cation and crown ether