Introduction

Olefins Metathesis
• Olefins metathesis is the process of rearranging carbon double bonds
• To meet growing energy demands, olefin metathesis could potentially be used to convert undesirable high and low molecular weight olefins into more useful mid-range olefins, shown below

Support Characterization

Nitrogen Adsorption

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>BET Surface Area (m²/g)</th>
<th>Micropore Surface Area (m²/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amorphous Alumina Before Calcination</td>
<td>568</td>
<td>27</td>
</tr>
<tr>
<td>Amorphous Alumina Calcined for 24 hours</td>
<td>358</td>
<td>13</td>
</tr>
<tr>
<td>Gamma Alumina Before Calcination</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td>Gamma Alumina Calcined for 24 hours</td>
<td>12</td>
<td>7</td>
</tr>
</tbody>
</table>

Solid State NMR

- 27Al NMR shows that 80% of the aluminum atoms in γ-Al₂O₃ are visible relative to AlN, while 22% of the aluminum atoms in the amorphous alumina are visible before calcination and only 5% are visible after calcination
- Using an external standard, the surface proton density of the γ-Al₂O₃ and the amorphous alumina were determined to be 5.1 and 2.0 H/nm², respectively

Optimal MTO Loading

- Even for similar surface dispersion, the amorphous alumina gives better activity
- In comparing the rate versus weight loading, it was found that the amorphous alumina shows an optimal loading much above γ-Al₂O₃

Conclusions and Future Directions

Isotopic Labeling for Mechanism Determination

- This material shows good activity at high Re loadings with no side products, which makes identifying the carbene source possible via 13C labeling of MTO
- GC-MS can be used to identify the number of active sites by determining extent of isotopic exchange with propylene

Acknowledgements
This work was made possible by funding from the Department of Energy and the National Science Foundation Graduate Fellowship Program. Special thanks to Ramzy Shalby for his help with NMR