

Highly Active Lewis Acidic Aluminum Ions for Propylene Oligomerization

Elizabeth Szymanski Jefferson High School, Lafayette, IN

Q1: Research Question

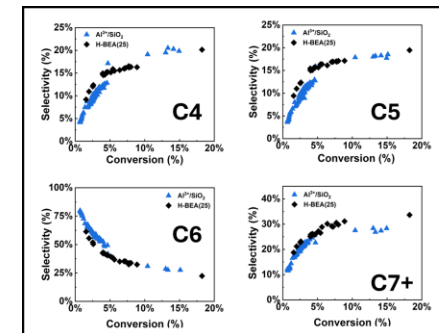
- Refining crude oil to make fuel creates toxic byproducts this experiment is trying to find a better working catalyst to use for the fuel industry to make hydrocarbon chains.
- Can a catalyst made from alumina silica have the same conversion rates as a zeolite and will it contain only Lewis acid sites?
- It is hypothesized tetrahedral aluminum ions on amorphous silica will form Lewis acid sites similar to ones found in zeolites and be active for hydrocarbon reactions.

Q2: Methodology

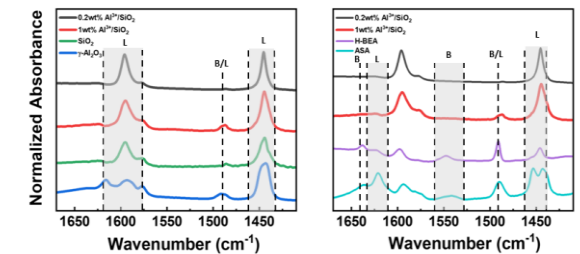
- Make catalysts out of aluminum and silica. The catalysts ratio from aluminum and silica should range from 0.1% to 1% aluminum.
- After the catalysts are made put it in a tube in a gas reactor.
- The gas will go the tube in a heated up reactor and it will go into a gas chromatograph.
- The gas chromatograph give the amounts of each product from the reaction.

Q3: Data Analysis and Results

These graphs show that the catalyst made Al_3+/SiO_2 produces the same products at similar conversion rates of that of the zeolite H-BEA.



This shows the tested catalyst against zeolites it shows Bronsted and Lewis acid sites This shows how the tested catalyst has Lewis acid sites with an absence of Bronsted acid sites.



Q3: Interpretation and Conclusion

- This data shows that both the catalyst tested and zeolites reactions' create the same products when doing propylene oligomerization with similar conversion rates.
- It proved with Infrared Spectroscopy that the acid sites doing the reaction were Lewis acid sites whereas Zeolites have both Bronsted and Lewis acid sites so either site could be the active.
- To improve or expand upon this experiment the catalysts made here could be tested to make actual gasoline.
- This expansion might consist of finding the best reaction conditions to run to get the types of hydrocarbon chains gasoline needs.