

SLATT UNDERGRADUATE STUDENT FELLOWSHIP

CHECK ONE: UPDATE FINAL REPORT

SLATT SCHOLAR:	Madison Mettey
FACULTY ADVISOR:	Dr. Emily Tsui
REPORT PERIOD:	5/28/18-12/14/18
PROJECT TITLE:	Synthesis of transition metal aluminosiloxide complexes as models of zeolite active sites for energy-related catalysis
CONNECTION TO ND ENERGY'S RESEARCH AREAS (CHECK ALL THAT APPLY):	<input checked="" type="checkbox"/> Energy Conversion and Efficiency <input type="checkbox"/> Sustainable and Secure Nuclear <input type="checkbox"/> Smart Storage and Distribution <input type="checkbox"/> Transformation Solar <input checked="" type="checkbox"/> Sustainable Bio/Fossil Fuels <input type="checkbox"/> Transformative Wind

MAJOR GOALS AND ACCOMPLISHMENTS:

List your major research goals and provide a brief description of your accomplishments (1-2 sentences). Indicate the percentage completed for each goal. Please use a separate sheet to share additional details, technical results, charts, and graphics.

MAJOR RESEARCH GOALS	ACTUAL PERFORMANCE AND ACCOMPLISHMENTS	% OF GOAL COMPLETED
Synthesize aluminosiloxide ligands with structures relevant to zeolite pores.	A lithium copper siloxide complex has been cleanly synthesized. Current reactions entail replacing lithium centers with aluminum. Additional reactions were conducted targeting molecules which supported aluminum by coordinating with multiple oxygen groups, which could then undergo copper metallation.	40
Metallation of aluminosiloxide ligands with transition metals	Various copper metallation reactions have been tested with aluminosiloxide compounds. Color changes and NMR indicated paramagnetic activity in some cases, however clean conversion has not been detected.	50
Synthesis and functionalization of ancillary aluminum ligands	A salicylaldimine compound was synthesized and metallated with aluminum by Dr. Emily Tsui. Various reactions have been run to functionalize aluminum-methyl bonds, most successfully using 1,1,3,3-tetraphenylsiloxanediol.	50

RESEARCH OUTPUT:

Please provide detailed information below regarding any output resulting from your research project. Please check with your faculty advisor if you are unsure how to respond.

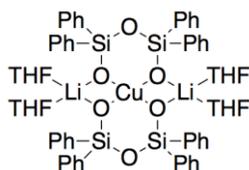
CATEGORY	INFORMATION
EXTERNAL PROPOSALS	(Sponsor, Project Title, PIs, Submission Date, Proposal Amount)
EXTERNAL AWARDS	(Sponsor, Project Title, PIs, Award Date, Award Amount)
JOURNAL ARTICLES	(Journal Name, Title, Authors, Submission Date, Publication Date, Volume #, Page #s)
BOOKS AND CHAPTERS	(Book Title, Chapter Title, Authors, Submission Date, Publication Date, Volume #, Page #s)
PUBLIC PRESENTATIONS, SEMINARS, LECTURES	(Event, Presentation Title, Presentation Date, Location) Summer Undergraduate Research Symposium, Synthesis of transition metal aluminosiloxide complexes as models of zeolite active sites for energy-related catalysis, July 25 th , 2018, University of Notre Dame Jordan Hall of Science Superdupergroup (with Brown and Illuc labs), Synthesis of transition metal aluminosiloxide complexes as models of zeolite active sites for energy-related catalysis, July 25 th , 2018, Nieuwland Hall of Science PINDU Inorganic Chemistry Conference, Synthesis of transition metal aluminosiloxide complexes as models of zeolite active sites for energy-related catalysis, December 1 st , 2018, University of Notre Dame Jordan Hall of Science
AWARDS, PRIZES, RECOGNITIONS	(Purpose, Title, Date Received)

INTERNAL COLLABORATIONS FOSTERED	(Name, Organization, Purpose of Affiliation, and Frequency of Interactions) Dr. Gregory Kortman, University of Notre Dame Tsui Lab, Dr. Kortman worked on synthesis of ancillary aluminum ligands, specifically “nacnac” ligands. These structures are extremely relevant to the project I worked on, and his results were taken into consideration when choosing other ligands to target.
EXTERNAL COLLABORATIONS FOSTERED	(Name, Organization, Purpose of Affiliation, and Frequency of Interactions)
WEBSITE(S) FEATURING RESEARCH PROJECT	(URL)
OTHER PRODUCTS AND SERVICES (e.g., media reports, databases, software, models, curricula, instruments, education programs, outreach for ND Energy and other groups)	(Please describe each item in detail) Part of ND Energy outreach program with Tsui lab. High school students enrolled in Trio came to our lab on two separate days and learned about what it was like to be a scientist, work in a lab, and go to college/graduate school. While there, students were able to set up and grow their own alum crystals, and watch a sublimation of benzoquinone. I was involved in applications including set up, fielding questions, and explaining the scientific processes occurring.
RESEARCH EXPERIENCE: Please let us know what you thought of your research experience: Did this experience meet your expectations? Was there something else that could have been done to improve your research experience? Were lab personnel helpful and responsive to your needs? What could have been done differently, if anything, to achieve additional research results?	
Overall I enjoyed my research experience. There was a bit of an adjustment transitioning into doing full time research, but I had a lot of guidance from my lab group. I had been working on my project during the school year, but I feel I gained a much more comprehensive grasp over the summer. I was not able to accomplish as much as I had hoped, but I feel that is largely due to the nature of my project and synthetic chemistry in general. It may have been nice to have an event or two over the summer to meet and get to know the other Slatt Fellows (outside of the events for all summer students.)	
Work in the fall allowed me to continue alumosiloxide research exploring the functionalization of compounds synthesized during the summer and the targeting of new molecules. A fraction of the fall semester was spent working with Dr. Gregory Kortman on synthesis of structures relevant to persulfide oxidation, but this project was put on hold for more promising alternatives.	

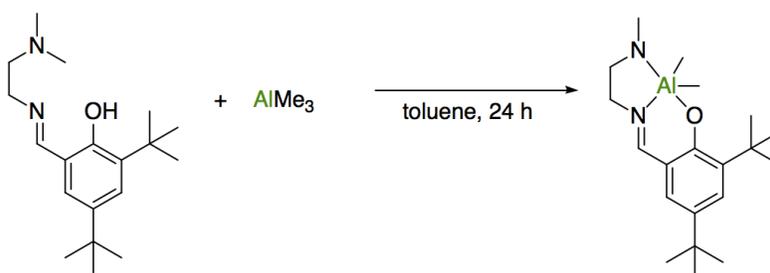
MAJOR GOALS AND ACCOMPLISHMENTS

(Additional Details, Technical Results, Charts and Graphics)

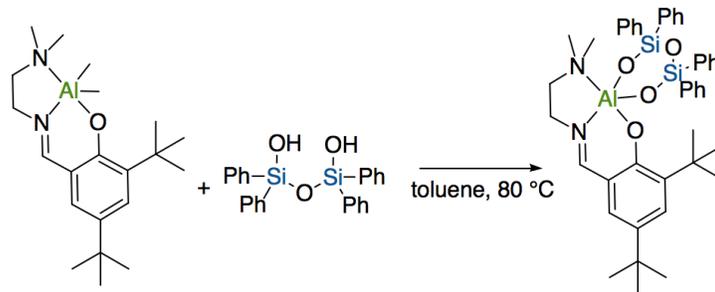
Copper Siloxide Complex



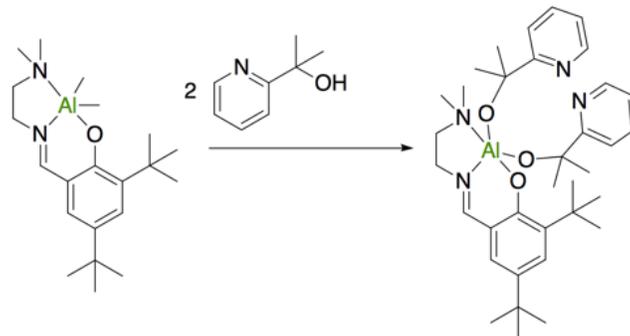
Synthesis of aluminum salicylaldimine ligand



Clean functionalization of aluminum compound with 1,1,3,3-tetra-phenylsiloxanediol



Clean functionalization of aluminum compound with 2-(pyridin-2-yl)propan-2-ol



Synthesis of an ancillary aluminum ligand with “OMOM” protecting group to be used in further condensation reactions

