

Thomas M. Rayder

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Education

- 2015-present Doctor of Philosophy, Chemistry (in progress)
Boston College, Chestnut Hill, MA
Advisors: Jeffery A. Byers and Chia-Kuang (Frank) Tsung
Thesis title: Modulation of Catalyst@MOF Host-Guest Composites in Pursuit of Synthetic Artificial Enzymes
- 2011-2015 Bachelor of Science in Chemistry, minor in Materials Science (with Distinction)
Worcester Polytechnic Institute

Research Experience

- 2015-present Graduate Research
Boston College
With Prof. Jeffery A. Byers and Prof. Chia-Kuang (Frank) Tsung

Investigated the effect of solvent on guest encapsulation in UiO-66 through “aperture opening” events resulting from dissociative linker exchange pathways. Demonstrated the improvement to the behavior of a molecular catalyst species resulting from this encapsulation. Applied this “catalyst@MOF” species as part of a tandem system to produce methanol from CO₂ through formic acid and ester intermediates at extremely low temperatures and with catalytic loadings of exogenous alcohol.

- 2014-2015 Undergraduate Research
Worcester Polytechnic Institute
with Prof. John C. MacDonald

Probed the efficacy of appending bulky monocarboxylic acids to the surface of metal-organic frameworks as a method for encapsulating molecular guest species within the host’s pores. Demonstrated that a dye that would otherwise leach from the pores of MOF-5 could be prevented from doing so through pore capping by triphenylacetic acid.

Teaching Experience

- 2015-2018 *Boston College*

Served as a teaching assistant for undergraduate courses in *General Chemistry, General Chemistry Lab* (twice), *Organic Chemistry, Analytical Chemistry, Analytical Chemistry Lab* (twice), and *Inorganic Chemistry*.

Honors, Appointments, and Professional Societies

Recipient of Brian Lawrence Gray Best Poster Award, Boston College	2018
Member of the American Chemical Society	2017-present
Recipient of Worcester Polytechnic Institute Presidential Scholarship	2011 - 2015

Publications

4. **Rayder, Thomas M.**; Bensalah, Adam T.; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “Modulation of Host Functionality for a Synthetic Active Site Mimic in CO₂ Hydrogenation to Methanol”, **2020**, Manuscript in preparation.
3. **Rayder, Thomas M.**; Adillon, Enric H.; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “A Bioinspired Multicomponent System to Convert Carbon Dioxide to Methanol”, **2020**, *Chem*, In Review.
2. Homan, Rick A.; Hendricks, Dalton S.; **Rayder, Thomas M.**; Thein, U Shwe; Fossum, Katherine J.; Claudio Vázquez, Adriana P.; Yan, Jingjing; Grimm, Ronald L.; Burdette, Shawn C.; MacDonald, John C.*, “A Strategy for Trapping Molecular Guests in MOF-5 Utilizing Surface-Capping Groups”, *Crystal Growth & Design*, **2019**, 19(11), 6331-6338, DOI: 10.1021/acs.cgd.9b00818
1. Li, Zhehui[‡]; **Rayder, Thomas M.**[‡]; Luo, Lianshun; Byers, Jeffery A.*; Tsung, Chia-Kuang* “Aperture-Opening Encapsulation of a Transition Metal Catalyst in a Metal-Organic Framework for CO₂ Hydrogenation”, *Journal of the American Chemical Society*, **2018**, 140(26), 8082-8085, DOI: 10.1021/jacs.8b04047. ([‡] = co-first author)

Presentations (Presenter Underlined)

10. **Rayder, Thomas M.**; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “Autocatalytic Conversion of CO₂ to Fuel Using Bioinspired Multicomponent Catalysis”, 50th Boston Regional Inorganic Colloquium, Boston, MA, October 5th, **2019**, poster presentation.
9. **Rayder, Thomas M.**; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “Autocatalytic Conversion of CO₂ to Fuel Using Bioinspired Multicomponent Catalysis”, 258th American Chemical Society National Meeting, San Diego, CA, INOR-628, August 28th, **2019**, oral presentation.
8. **Rayder, Thomas M.**; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “Autocatalytic Conversion of CO₂ to Fuel Using Bioinspired Multicomponent Catalysis”, Gordon Research Conference, “Porous Materials from Invention to Emerging Applications”, Andover, NH, August 6th-7th, **2019**, poster presentation.
7. **Rayder, Thomas M.**; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “Autocatalytic Conversion of CO₂ to Fuel Using Bioinspired Multicomponent Catalysis”, Gordon Research Seminar, “Designing and Understanding Tailor-Made Nanoporous Materials by Combining Theory and Experiment”, Andover, NH, August 3rd, **2019**, poster presentation.

6. **Rayder, Thomas M.**; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “Autocatalytic Conversion of CO₂ to Fuel Using Bioinspired Multicomponent Catalysis”, 2nd New England Energy Research Forum, Worcester, MA, June 10th, **2019**, poster presentation.
5. **Rayder, Thomas M.**; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “One-Pot Production of Methanol from CO₂ via Tandem Catalysis Employing an Encapsulated Catalyst@MOF Species”, 48th Boston Regional Inorganic Colloquium, Chestnut Hill, MA, March 2nd, **2019**, poster presentation.
4. **Rayder, Thomas M.**; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang*, “One-Pot Production of Methanol from CO₂ via Tandem Catalysis Employing an Encapsulated Catalyst@MOF Species”, Boston College Graduate Research Symposium, Dover, MA, October 8th, **2018**, poster presentation.
3. **Adillon, Enric H.**; Li, Zhehui; **Rayder, Thomas M.**; Byers, Jeffery A.*; Tsung, Chia-Kuang* “Role of confinement for host-guest interactions in UiO-66”, 256th American Chemical Society National Meeting, Boston, MA, CHED-244, August 20th, **2018**, poster presentation.
2. **Rayder, Thomas M.**; Li, Zhehui; Adillon, Enric; Byers, Jeffery A.*; Tsung, Chia-Kuang* “Aperture-opening encapsulation of a transition metal catalyst in a metal-organic framework for CO₂ Hydrogenation”, 256th American Chemical Society National Meeting, Boston, MA, INOR-17, August 19th, **2018**, oral presentation.
1. **Rayder, Thomas M.**; MacDonald, John C.*, “Investigation of Triphenylacetic Acid as a Trapping Agent for Sealing Molecular Guests Within Porous Metal-Organic Frameworks”, 1st Joint NanoWorcester/AVS New England Spring Meeting, Worcester, MA. April 29th, **2015**, poster presentation.

Appearances of Work in Popular Media

1. R. F. Service. Crystalline nets harvest water from desert air, turn carbon dioxide into liquid fuel. *Science*. **365**, 964-965 (2019).

Local, National, and Professional Meeting Organization

- Co-organizer (with Jeffery A. Byers) of 48th Boston Regional Inorganic Colloquium, *March 2, 2019*
- Discussion leader for session “Nanoporous Materials and Catalytic Transformations” at Gordon Research Seminar, Andover, NH, *August 3, 2019*

Student Mentorship Experience

Graduate Students

Current (2): Adam Bensalah, Banruo Li

Undergraduate Students

Current (3): Noella D’Souza, Trevor Hale, Lucy Hanson

Past (1): Enric Adillon