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Wednesday, October 18th, 2023

Watt Hotel Rahway
1403 Irving St., Rahway, NJ 07065

Prof. Marc D. Porosoff

Department of Chemical Engineering
University of Rochester

Pathways for enabling a carbon neutral economy with CO_2 hydrogenation

Reverse water-gas shift (RWGS) followed by Fischer-Tropsch synthesis (FTS) is a potential pathway for transforming CO_2 into value-added chemicals and fuels. The combined RWGS-FTS reaction pathway is currently being investigated for the *seawater-to-fuel* process, which uses CO_2 and H_2 produced via electrolysis of seawater and is ideally powered by nuclear or renewable energy. Synthesis of fuels through a renewable process not only benefits the circular carbon economy, but also may provide U.S. Navy carrier groups with a strategic advantage when they operate away from the mainland.

We recently developed a highly selective K-Mo_2C RWGS catalyst, which can achieve >99% CO selectivity at 450 °C and a GHSV of 132,000 mL/g/h. Under these conditions, the RWGS effluent contains ~50% unreacted CO_2 after water removal, which presents a challenge for downstream fuel synthesis via FTS. Instead of separating the CO from CO_2 via traditional methods, we are developing catalysts for reactive separations of CO/CO_2 mixtures over single-atom alloy

(SAA) Ru-Co catalysts. Aberration corrected-transmission electron microscopy (AC-TEM) and H_2-temperature-programmed reduction (TPR) illustrate that the Ru single atoms are well-dispersed on the surface of Co nanoparticles, and the Ru single atoms decrease the reduction temperature of Co. Density functional theory (DFT) calculations of segregation energies agree with AC-TEM observations, and simulated reaction pathways of -CH- coupling and dissociation illustrate that Ru dopants may slow alkane-chain growth without affecting chain termination. Our results suggest that the Ru atoms in the Ru-Co SAA preserve Co in a reduced phase under reaction conditions and are promising catalysts for reactive separations of CO/CO_2 mixtures. At the conclusion, I will discuss new methods of catalyst representation that are highly promising for accelerating decarbonization.

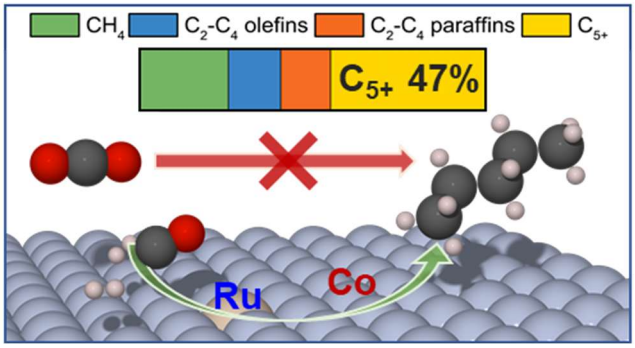

Figure. Ru-Co SAAs promote C-C bond formation from CO in CO/CO_2 mixtures.

Speaker Bio

Professor Marc Porosoff received his BS in 2009 and MS in 2010, both in Chemical and Biomolecular Engineering from the Johns Hopkins University. In 2015, he completed his PhD in Chemical Engineering at Columbia University, with a thesis on developing catalysts for carbon dioxide conversion. Porosoff then worked as a National Research Council sponsored postdoctoral fellow at the Naval Research Laboratory on the *seawater to fuel* project. At Rochester, Porosoff is investigating low-cost, alternative catalysts for CO_2 hydrogenation into value-added chemicals and fuels. Porosoff's research targets relationships between chemical reactivity and catalyst electronic/structure properties through catalyst synthesis, *in situ* analytical techniques, and reactor studies.

Schedule	
Social Hour (Cash Bar)	6:00 PM
Dinner	6:45 PM
Presentation	7:30 PM

Meeting Fees	
Professional Members	$40
Non-members	$50
Students	$25 (Student Members = $10)
Retired/Post-Doc/Unemp.	$40 (Members = $30)
Annual Membership Dues	***$35 (Students = $15)***

Deadline for reservations is **12:00PM Tuesday, October 17th, 2023**

Please RSVP online using the online form.

To renew your membership, please visit this link.