Environmental Engineering & Sciences

Department of Civil and Environmental Engineering

CEE 595AG Seminar

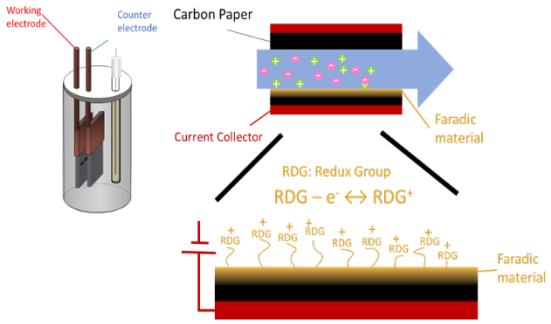
Friday, April 7, 2023 | 10:00 – 10:50 a.m. CST | 3310 Yeh Center

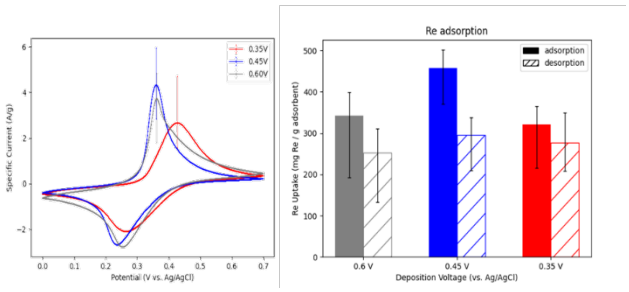
Faradaic Rhenium Recovery with Polyvinyl Ferrocene (PVF) Coated Carbon Electrodes

Presented by: Yurui Li (Advisor Prof. Cusick)

Rhenium, a valuable rare element used in catalysts and superalloys, is difficult to recover in micromolar concentrations. Electrodes coated with the redox active polymer poly vinyl ferrocene (PVF) have shown the ability to selectively adsorb several transition metal oxyanions, but limited adsorption capacity and longevity remain a challenge for these selective electrosorption technologies. In this study, we elucidate the impact of electrochemical deposition conditions on PVF coating as measured by capacitance, rhenium uptake, and longevity. PVF films were electrodeposited onto carbon substrate electrode at three different potentials across the oxidation window of the ferrocene-based metallopolymer to understand how the rate of charge transfer influences the resulting electrodeposited polymer coating. It was observed that PVF films electrodeposited at the peak oxidation current potential of 0.45 V (vs. Ag/AgCl) showed both the highest adsorption of Rhenium (458 ± 61 mg Re/g adsorbent) and capacitance (217 F/g).

In comparison, the electrodeposition at 0.35 V and 0.6 V leads to a lower average capacitance 355.36 mg Re/g adsorbent and 342.03 mg Re/g adsorbent respectively. The enhanced performance for 0.45 V electrodeposited electrode can likely be attributed to a more stable deposition structure of the polymer, which enhances adhesion substrate and charge transfer between the substrate and the PVF. The 0.45 V electro-deposited PVF-carbon paper (PVF-CP) electrode illustrates high capacity and stability, indicating the benefits of polymer coating on selective adsorption of rhenium and prevention of electrode corrosive degradation in capacitive deionization systems. The excellent rhenium uptake and longevity demonstrates potential and will be the platform towards a full techno-economic analysis of the hybrid adsorption system in the future.





Yurui Li | Advisor Prof. Cusick

Yurui is a 2nd year PhD student working with Professor Roland Cusick in Environmental Engineering and Science. She got her Bachelor's degree in Environmental Engineering from Tongji University in China and her Master of Science from UIUC. Her current research is on faradic material incorporated capacitive deionization (CDI) for water treatment and resource recover. Yuri is also interested in technology economy analysis (TEA) using technical models and her future plan is to conduct TEA on the polymer based CDI. In her spare time, she enjoy playing the piano and hiking.