

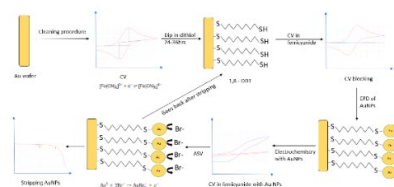
Electrophoretic Deposition and Stripping of Metal Nanoparticle-Molecule-Metal Film Junctions

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Abstract

Self-assembled monolayers (SAMs) of organic molecules like thiols and dithiols provide inexpensive and versatile surface coatings for applications in the fields of electrochemistry, physics, molecular biology and material science. The strength of the Au-thiolate interaction formed between dithiols and Au surfaces provides the basis to fabricate robust SAMs for diverse applications, including metal-molecule-metal junctions., nanofabrication, optical materials enhancement, electrocatalysis and sensing. My work involves the electrophoretic deposition (EPD) of 4 nm diameter Au nanoparticles (NPs) on top of robust dithiol SAMs on 2D Au films to form Au NP-molecule-Au film junctions. The blocking of electrochemical oxidation/reduction of $\text{Fe}(\text{CN})_6^{3-/4-}$, $\text{Ru}(\text{NH}_3)_6^{2-/3-}$, and hydroquinone confirms formation of robust dithiol SAMs while the oxidation/reduction current with slow kinetics appears following EPD of 4 nm diameter Au NPs on top of the Au/dithiol, confirming formation of the Au NP-molecule-Au film junction. Oxidative stripping of the Au NPs leads to a return in the blocking of the electrochemistry, further confirming successful junction formation. The Au NP oxidation potential is lower for the 4 nm Au NPs compared to the bulk Au film, but has a higher oxidation potential than Au NPs on indium-tin-oxide-coated glass electrodes (glass/ITO), showing that the underlying electrode affects the thermodynamics of metal NP oxidation. Future work will focus on the electron transfer kinetics to different redox molecules, Au NP oxidation thermodynamics, and electrocatalysis with various metal NPs and dithiol SAMs.

GENERAL SCHEME OF MY WORK



Biography of Presenter

I am Fahad Bin Halim and I am from Bangladesh. I have completed my undergraduate studies from Applied Chemistry and Chemical Engineering from University of Dhaka in the year 2019. I am currently in the chemistry PhD program working under the guidance of Dr. Francis P. Zamborini

