MRSEC SEMINAR SERIES

"The Upper Limit of Charge and Spin Transport in Atomic and Molecular Junctions."

The inherent electronic mismatch between molecules and metals is a general limitation for efficient electron transport in molecule-based electronics, including organic photovoltaic cells, nanoscale organic spin-valves, and single-molecule junctions. To date, the study of electronic transport across metal-molecule interfaces focused on low conductance governed by tunneling or hoping processes. Recently, we fabricated highly transmitting single-molecule junctions in order to study the upper limit of conductance across metal-molecule interfaces. We revealed two fundamental mechanisms for conductance saturation near full electron transmission: a Band-like transmission and Conductance pinning. These mechanisms can be used to optimize efficient charge injection, information transfer and recombination processes across metal-molecule interfaces.

The interactions of molecules with metals can be further used to confront the inherent limited spin-injection from ferromagnetic metal electrodes. In this respect, we find indications for perfect spin filtering in nickel-oxygen atomic wires. The presented effect is achieved by selective orbital hybridization, which is an attractive way for gaining enhanced magnetic and spin transport properties at the atomic scale.

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11:00 a.m. – 12:00 p.m.