Coupling of electrons, photons, and vibrations in hydrocarbon based molecular junctions

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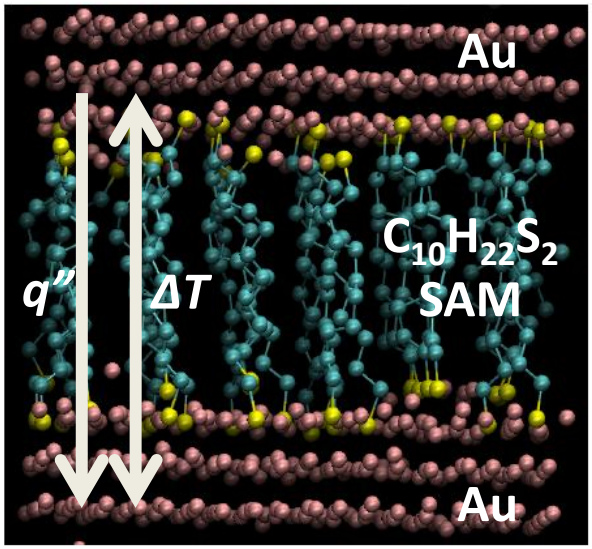
Molecular junctions are the building blocks of organic-inorganic hybrid materials currently being researched as alternatives to traditional semiconductor based electronics, thermoelectrics, and photovoltaics. Successful understanding of electron-vibration and electron photon coupling - effects manifested in joule heating, thermopower, and photoconductrance - will unlock a world of petroleum derived materials for efficient energy conversion. . In order to understand how vibrations couple to electrons and photons, we have initially focused on understanding how vibrations within the molecule couple to phonons and electrons within the inorganic electrodes. To do so, we formed self assembled monolayer (SAM) junctions using a unique transfer printing approach and measured their thermal conductance (*G*) using a thermoreflectance technique. We find that Au-decanedithiol-Au SAMs have higher thermal conductance than Au-decanemonothiol-Au SAMs indicating the importance of covalent bonding to phonon-vibration coupling.



SAM Thermal Interface Conductance (*G*)

G=q"/ΔT