A test structure for electrical characterization of metal-molecule-metal junctions was built using simplified processing tools and procedures. The test device consisted of nanometer scale well with a gold bottom, a self-assembled molecular monolayer on the bottom of the well, and capped with titanium/gold. The test device was similar to a device built by a group in Yale but had simplifications in the area of processing tools and conditions. The device tested alkanethiol molecules that were found to tunnel electrons in metal-molecule-metal junctions. The parameters for tunneling, such as potential barrier height ($f_b$) and barrier shape $(a)$ were determined. The values of these parameters are comparable to those found in the literature. An exponential dependence of tunneling current to the chain length was also found. The exponential decay factor calculated by experimenting with different chain length molecules agreed well with the literature values.

Our new simplified test structure will enable us to determine I-V characteristics and other fundamental measurements for a wide variety of molecular species. Knowledge of basic transport and conduction mechanisms is critical for the advancement of molecular electronic devices. The results will enable parameter extraction for our circuit modeling effort. This will lead to circuit-based requirements on device parameters and performance in the context of real architectures including CMOS/Nano types.

References:
1. For further information on this project send e-mail to lharriott@virginia.edu