ACS PRF-AC: Studies of Charge Injection, Conduction, and Trapping in Organic Electronics Materials Using Advanced Electric Force Microscopies

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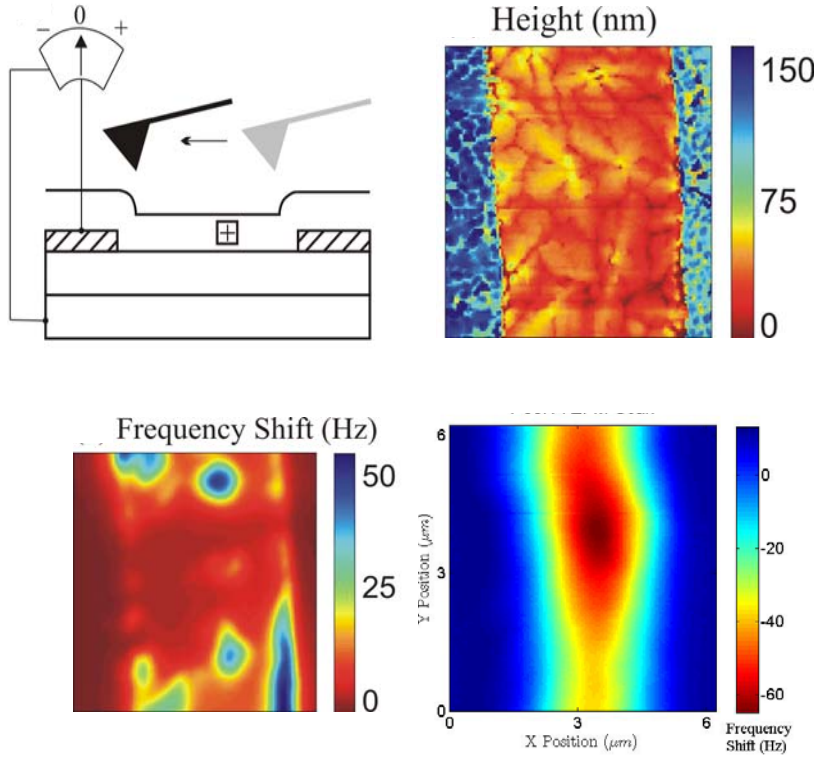
Research Objective: Organic electronic materials – carbon based molecules that behave like semiconductors – might one day be used for cheap mass-produced electronics, sensors, and high-efficiency solar cells. A major problem with organic electronic materials is that they trap charge. Since the mechanisms of charge trapping are not well understood, it is not clear how to move forward with developing new materials and improving devices.

Approach: We are developing a scanned probe microscope for imaging the local concentration and kinetics of charge trap formation in organic electronic materials.

Significant Results: We find that charge trapping in 6,13-Bis(triisopropylsilylethynyl) pentacene is significantly different than in pentacene.

Broader Impact: Local measurements of charge trapping in thin organic films can identify promising new organic semiconductors.



Upper left; Studying charge trapping in organic thin-film transistors by electric force microscopy. Upper right: atomic force microscope topography of a polycrystalline pentacene transistor. Lower Left: electric force microscope image of trapped charge (blue) in polycrystalline pentacene. Lower right: electric force microscope image of trapped charge in the pentacene variant 6,13-Bis(triisopropylsilylethynyl) pentacene.