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Selectively Doping Individual C₆₀ Molecules and Clusters Atom by Atom

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Future molecular technologies are expected to rely on the ability to locally control the electronic properties of single molecules and molecular complexes. It is critical therefore to understand the influence on molecular properties of different molecular spatial and electronic configurations in the presence of metal electrodes. Here we present a novel local probe technique for constructing and investigating electronically modified molecular complexes. Our technique is based on the molecular manipulation capabilities of a scanning tunneling microscope for controllably changing the charge state of C₆₀ molecules [1]. By moving a single C₆₀ molecule over successive K atoms adsorbed onto the Ag(001) surface, charge-donating K atoms are attached to the fullerenes' outer surface. This allows the synthesis of isolated K_xC₆₀ complexes in a controllable and reversible manner for x ranging from 0 to 6. The doped C₆₀ molecules can then be combined using molecular manipulation to form larger molecular complexes where the local doping level is precisely controlled. I will discuss the topographic and spectroscopic properties of such selectively doped K_xC₆₀ complexes and implications for possible devices.

[1] R. Yamachika, M. Grobis, A. Wachowiak and M. F. Crommie, *Science* **304**, 281 (2004).