Reliable Formation of Single Molecule Junctions with Air-Stable Diphenylphosphine Linkers

We measure the conductance of single Au-molecule-Au junctions with a series of air-stable diphenylphosphine-terminated molecules using the scanning tunneling microscope-based break junction technique. Thousands of conductance versus displacement traces collected for each molecule are used to statistically analyze junction conductance and evolution upon elongation. Measured conductances for a series of alkane-based molecules exhibit an exponential decrease with increasing length, as expected for saturated molecules, with a tunneling decay constant of 0.98 (0.04. Measurements of junction elongation indicate strong metal-molecule binding, with a length that increases with the number of methylene groups in the backbone. The phosphine binds selectively to undercoordinated gold atoms through a donor-acceptor bond with a binding energy of about 1 eV.