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Probing Molecule-Molecule Interactions Through Atomic Force Spectroscopy ANDRAS MAGYARKUTI, Department of Applied Physics and Applied Mathematics, Columbia University, COLIN NUCKOLLS, Department of Chemistry, Columbia University, LATHA VENKATARAMAN, Department of Applied Physics and Applied Mathematics, Columbia University — We investigate the role of molecule-molecule interactions at the single-molecule level using a custom high-resolution atomic force microscope (AFM). We perform break-junction measurements using a gold substrate and gold-coated AFM cantilever on a series of methyl-sulfide terminated alkane chains. We measure, simultaneously, two independent quantities for each junction: force and conductance. This gives us insight into junction elongation and rupture processes. We use conductance as a signature of the junction structure and electronic characteristics and use the measured force to understand its mechanical properties. We find that molecular junctions form with one or two molecules bridging the gap between the cantilever and substrate, with the two-molecule junction having roughly twice the conductance of the one-molecule junction. More importantly, we find that the probability to form a two-molecule junction is higher for alkanes with an odd number of carbon atoms indicating that the van der Waals interactions between the two molecules might be important in forming these junctions. We discuss the implications of these results and compare them to those obtained for conjugated molecules.

Andras Magyarkuti
Columbia Univ

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