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Solvent-dependent thermal effects on conductance across a series of molecular wires.[1] GIACOMO LOVAT, ANDREW PINKARD, XAVIER ROY, LATHA VENKATARAMAN, Columbia University — Charge transport through a molecular wire is a function of not only the molecular junction itself, but also the environment of that junction. As electronics continue to miniaturize, elucidating this connection will lead to devices with greater versatility and functionality, while also gaining a more fundamental understanding of principles that govern molecular electronics. In this context, thermal effects on conductance in single-molecule junctions have been the focus of a relatively small number of studies. Here, we examine the temperature-driven conductance changes in single-molecule junctions fabricated with the scanning tunneling microscope break-junction (STM-BJ) technique as a function of 1) molecular length 2) backbone structure, 3) charge carrier type and 4) solvent polarity. We demonstrate that tunneling conductance across single-molecule junctions varies with temperature and we attribute this observation to temperature-dependent polarity of the environment. We argue that the reorganization of the solvent dipoles in the vicinity of the electrode surface alters the alignment of the frontier molecular orbitals relative to the metal Fermi level and has a significant impact on molecular conductance.

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