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Electron Conduction Mechanism And Inelastic Electron Tunneling Spectroscopy Of Porphyrin In A Nanoscale Molecular Junction TERESA ESPOSITO, PETER H. DINOLFO, VINCENT MEUNIER, KIM MICHELLE LEWIS, Rensselaer Polytech Inst — In order to determine the mechanism for electron conduction through a porphyrin molecular junction, temperature dependent current-voltage (I/V) studies have been performed and compared to existing models of electron transport. Porphyrin molecular junctions are being studied for their potential application as an interconnect in molecular electronics due to their low attenuation factor (β <0.01 nm^{-1}). Based on previous studies of porphyrin molecules the mechanism of conduction is expected to be direct tunneling. Three types of porphyrins are being investigated: a free base porphyrin, and porphyrins with either a zinc or an iron atom ligated to the porphyrin ring. Molecular junctions are formed by depositing porphyrins into a 3-5 nm gap created using a zig-zag electromigration technique from a 30x50 nm gold nanowire. I/V, dI/dV, and d^2I/dV^2 are measured simultaneously at temperatures from 4.2 to 300 K. d^2I/dV^2 is the inelastic electron tunneling spectrum (IETS) of the molecular junction, which is used to verify the presence of a molecule in the gap. Peaks in the spectra indicate the excitation of a vibrational mode which are compared to Fourier transform infrared spectroscopy and theoretical density functional theory calculations.

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