Synthesis and Characterization of Nanoparticle Assemblies for Electronic Applications

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While significant effort has been made to synthesize molecular wires for electronic applications, the ability to insert these molecules between two metallic contacts with directional control has yet to be demonstrated. Control over molecular orientation is critical to the development of molecular devices such as diodes, capacitors and transistors. In this study, directional control is achieved using orthogonal self-assembly to synthesize electronic junctions between nanoparticles of different compositions. Phenyl ethynylene oligomers were synthesized with two different end groups, a thiol which exhibits preferential binding to gold and an isocyanide which exhibits preferential binding to platinum. Preliminary studies indicate that these heterodimeric structures do form; however, characterizing these structures presents additional challenges. Transmission electron microscopy, size-exclusion chromatography, capillary electrophoresis and small-angle x-ray scattering are evaluated for their ability to characterize these structures with statistical accuracy. Once effective characterization techniques have been established, binding conditions can be optimized and separation techniques developed.