Abstract Submitted
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Self-aligned lithography and in-situ assembly of chemically responsive single-molecule transistors[1] JINYAO TANG, JENNIFER KLARE, YILIANG WANG, ETIENNE DE POORTERE, COLIN NUCKOLLS, SHALOM WIND, Columbia University — We report the fabrication and assembly of single-molecule transistors comprising ultrathin metal electrodes separated by a nanoscale gap, which is bridged by a single molecule or a small number of molecules. The electrodes sit upon a conductive substrate, which serves as a gate, separated by a thin gate dielectric, and the gap is defined by a completely self-aligned process involving the lateral oxidation of a sacrificial thin film of Al. Devices with gaps ranging from $\sim$ 2 - 10 nm are fabricated with yields approaching 80%. Highly conjugated bis-oxazole molecules are assembled within the gaps in a sequential fashion, relying upon individually designed end-group chemistry to control the attachment of molecular units to the metal electrodes and the modular assembly of the bis-oxazole units, respectively. In addition, metal ion complexes are used to reversibly attach and detach terpyridyl molecular units from one another. Fully assembled devices display distinctive electrical response, which is strongly modulated by the molecular assembly and attachment.

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