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Non-volatile multilevel Memory Based on Nanowire / Molecule Heterostructures CHAO LI, Univ. of Southern California, BO LEI, WENDY FAN, NASA Arms, CHONGWU ZHOU, USC TEAM, NASA ARMS COLLABORATION — A multilevel molecular memory device was constructed by coating In_2O_3 nanowire FETs with a self-assembled monolayer of Fe^{2+}-terpyridine compound. This bottom-up process takes advantage of both the nanowire and the redox-active molecules, as discrete multilevels naturally exist in an ensemble of redox-active molecules, while precise charge sensing can be carried out with a semiconducting nanowire transistor. In the demonstration, charges were precisely placed at up to eight discrete levels by altering the population of reduced / oxidized molecules. Gate voltage pulses and current sensing were used for writing and reading operations, respectively. More importantly, these devices exhibited ultralong retention up to 600 hours and great reliability. This approach solved the long-standing reliability issue by moving molecules outside the conduction path, and multilevel memory represents a conceptual breakthrough for molecular devices.

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