Supporting Information

Redox-Active Molecular Nanowire Flash Memory for High-Endurance and High-Density Nonvolatile Memory Applications

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X-ray photoelectron spectroscopy (XPS) characterization was performed on samples consisting of Ru_2 molecules attached to a p-type Si (100) substrate with a thin (2~3 nm) SiO_2. Figure S1 shows the XPS results of a $Ru_2/SiO_2/Si$ sample and a SiO_2/Si reference sample. Ru 3p and Ru 3d peaks were clearly observed with the Ru_2-attached sample compared with the reference sample.

Cyclic voltammetry (CV) characterization was performed on samples consisting of the Ru_2 molecules attached onto the patterned square-shaped active area that was etched into a 110 nm SiO_2/Si substrate. The active area is 100×100 μm^2. Figure S2 shows the schematic of CV characterization setup. The measurements were carried out in a standard probe station, with the backside contact made via the probe station chuck. A solution of 1.0M tetrabutylammonium hexafluorophosphate (TBAH) in propylene carbonate (PC) was used as the conducting gate electrolyte. Polypropylene micropipette tip containing the silver counter electrode and the electrolyte was lowered until only a small amount of electrolyte was spread across the active area. During the measurement, the voltage was applied on the substrate, and the CV was obtained using a CHI600 electrochemical analyzer.

Figure S3 illustrates the CV of the electrolyte-Ru_2-oxide-silicon capacitor structure at 1 V/s scan rate. Two pairs of oxidation/reduction peaks were observed, related with the redox behavior of the two redox sites in Ru_2 molecule.

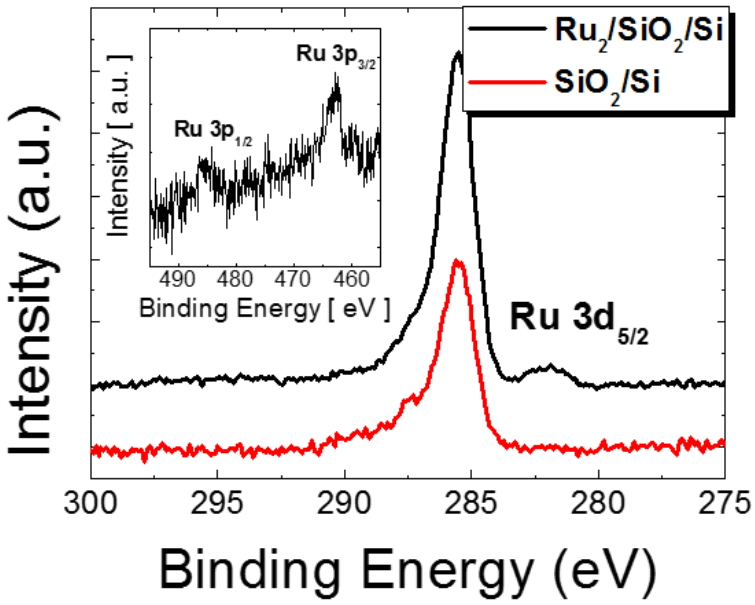

Figure S1. XPS of the SiO_2/Si samples with and without Ru_2 molecule attachment. Inset: XPS of the Ru_2/SiO_2/Si sample showing Ru 3p peaks.

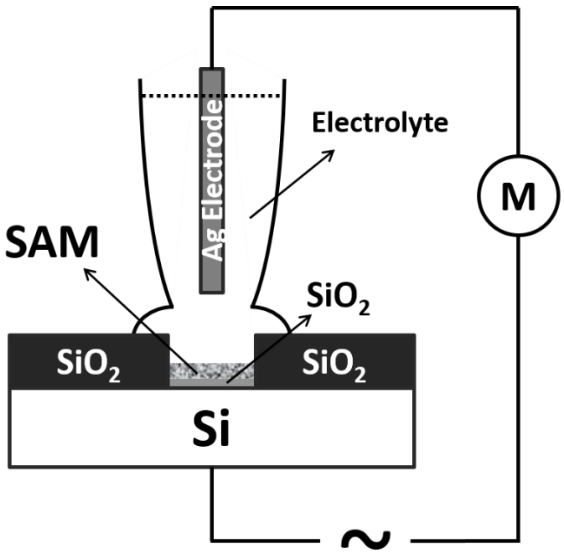

Figure S2. Schematic of the characterization setup for CV measurements. "~" represents the voltage source for the measurement, and M represents the electrometer.

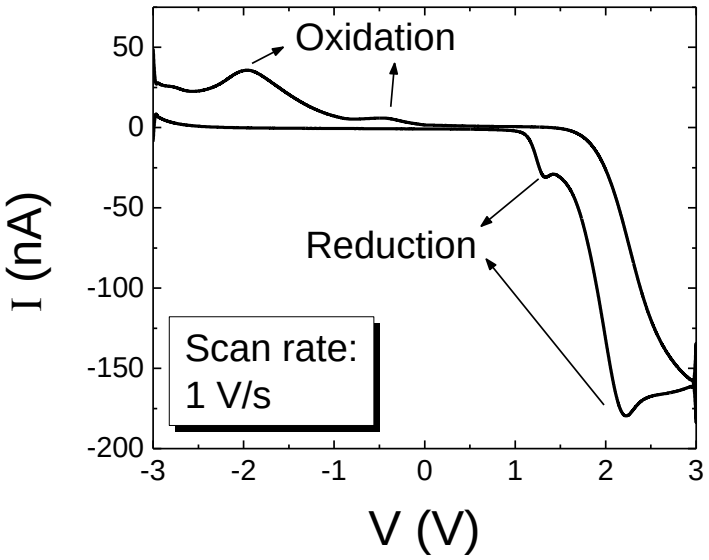

Figure S3. CV of the electrolyte-Ru_2-oxide-silicon structure at 1 V/s scan rate.