Electron Transport of Quinoidal Fused Oligosilole Derivative
Demonstrated by Scanning Tunneling Spectroscopy

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One of Si-bridged quinoidal fused oligosilole derivatives (Si-2) which has a 20 π-conjugated structure with two silicon atoms connected to π-conjugated parts can be a good candidate for single molecular device. In the molecular electronic device, π-conjugated molecules often face structural instability for change in their valence charge. However, quinoidal fused oligosilole derivatives can be very stable under charged and air ambient conditions because silicon atoms can effectively suppress molecular interactions.1 We evaluate molecular functions by observing STM (scanning tunneling microscopy) images and measuring STS (scanning tunneling spectroscopy). Tunneling currents are measured on the individual Si-2 molecule based on W-tip/vacuum/Si-2/Au(111) structure at room temperature (RT). The molecular structure of Si-2 is in Figure 1. The width and length of Si-2 are 1.5 nm and 1.8 nm, respectively. Two SH groups can chemisorb to Au(111) surface and work as tunneling barrier because of strong S-Au bonding. I-V characteristics under forward and backward bias voltage sweep are shown in Figure 2a indicating no current region between -0.6 and 0.6V. Figure 2b shows dI/dV–V characteristics based on the I-V characteristics in Figure 2a. The observed dI/dV peaks and shoulders will be discussed with the energy levels of molecular orbitals and Fermi energy of Au and W.

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Fig 1. Molecular structure of Si-2. Fig 2. (a) I-V and (b) dI/dV-V characteristics of Si-2 on Au(111).