Highlights 2014

Ballistic Transport at the Nanometric Inhomogeneities in Au/Nb:SrTiO₃ Resistive Switches

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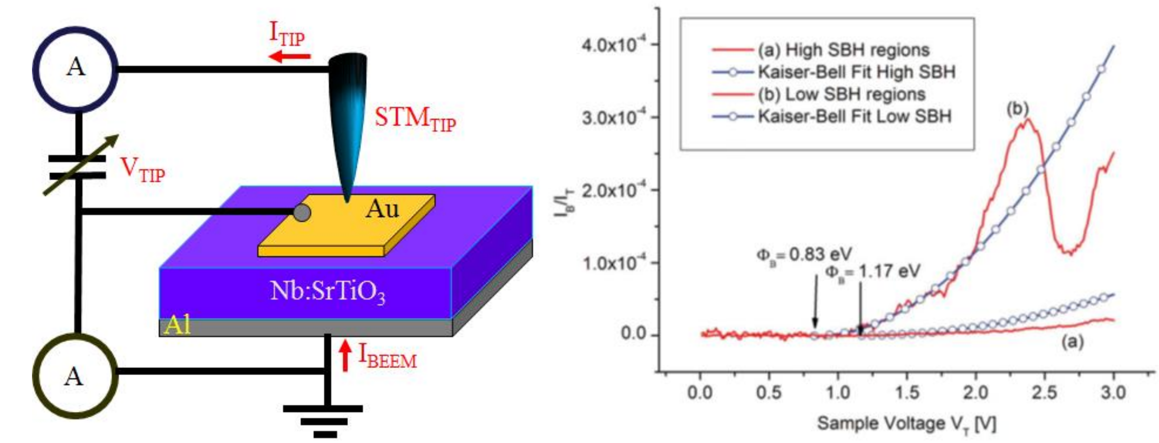
Advanced Materials Interfaces 2014, 1300057

Nanometer-scale alterations of the Schottky barrier represent one of the microscopic mechanisms proposed to explain the resistance switching in transition-metal oxide cells. We report on novel Ballistic Electron Emission Microscopy (BEEM) experiments aimed to directly visualize and quantify the local inhomogeneities of the effective Schottky barrier height on Au/Nb:$SrTiO_3$ Schottky junctions dominated by interfacial resistance switching effects. The voltage-dependent variation of the local barrier height of the nanometric patches could explain the non-ideal behaviour of the resistance switching effects.



(Left) Schematic diagram of BEEM: The hot electrons are injected from the Scanning Tunneling Microscopy (STM) tip into a thin Au film (metal base) grown on Nb:$SrTiO_3$ substrate. The electrons with an energy higher than the local Schottky barrier high (SBH) travel through the Au/Nb:$SrTiO_3$ interface and are collected at an Ohmic contact at the backside of Nb:$SrTiO_3$. The energy, location and flux of the hot electrons can be controlled by varying the tip voltage, position and tunnelling current respectively. (Right) BEEM spectra (ballistic current normalized to the tunnelling current vs tip voltage) were acquired over different locations showing (a) regions with low transmittance and high SBH and (b) high transmittance with lower SBH (solid lines). The solid line-open circles curves are fits with the Kaiser-Bell model.