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Evolution of Two Dimensional Surface State Electrons near the Metal-Molecule Boundary KYAW ZIN LATT, HAO CHANG, SAJIDA KHAN, ANDREW R. DILULLO, NQPI, and Dept of Physics & Astronomy, Ohio University, SAW WAI HLA, NQPI, and Dept of Physics & Astronomy, Ohio University; Nanoscience and Technology Division, Argonne National Laboratory, Lemont, IL 60439 — The existence of a surface state just below the Fermi level ($\sim$ -65 meV) on Ag(111) surface generate two-dimensional and nearly free electrons gas parallel to the surface. Here, how the surface state electrons evolve at the molecule-metal boundary has been investigated by using low temperature tunneling microscopy, tunneling spectroscopy, and spectroscopic mapping. We choose nanoscale molecular clusters composed of BETS and $GaCl_4$ f on Ag(111) surface as the molecular layer. dI/dV tunneling spectroscopy data are then measured across the metal-molecular cluster boundary and the data clearly reveal the expected surface state on-set at -65 $\pm$ 5 mV on bare Ag(111) terrace away from the molecular clusters. However, the intensity of the surface state on-set exponentially decreases starting at $\sim$ 1.5 nm distance from the molecule-metal boundary and decayed under the molecular layer. Moreover, the surface state on-set energy also is shifted towards the Fermi level indicating the depopulation of the surface state electrons near the molecular clusters.

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