ELECTRONIC STRUCTURE OF HIGHLY ORDERED C_{60} CLUSTERS ON Au(887)

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We present an analysis of the electronic structure of C_{60} adsorbed on a vicinal Au(111) surface at different fullerene coverage using photoemission, x-ray absorption, and scanning tunneling microcopy/spectroscopy (STS). STS provides a straightforward determination of the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO) levels with respect to the Fermi energy. At C_{60} coverage of 0.5 and 1 ML a 2.7 eV wide HOMO-LUMO gap is found. The near-edge x-ray absorption fine structure (NEXAFS) spectrum for the 0.5 ML C_{60} nanomesh structure displays a significant intensity at the low energy side of the LUMO exciton peak, which is explained as due to absorption into HOMO-LUMO gap states localized at individual C_{60} cluster edges. From 0.5 to 1 ML we observe a rigid shift of the HOMO-LUMO peaks in the STS spectra and an almost complete quenching of the gap states feature in NEXAFS.