Structure and local electronic properties of atomic nanowires on a Cu-nitride surface: tunneling microscopy and spectroscopy investigations

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Self-organized growth of surface supported nano-structures like atomic nanowires are likely to play important role in future electronic devices where the confined electrons show quantization phenomena. The formation and growth behavior of epitaxial atomic nanowires of *3d, 4d* and *5d* elements on a corrugated molecular Cu_3N network on a Cu(110) surface have been reported. An element independent growth of nanowires consisting of 5 atomic rows (~ 1 nm in width) running along [1-10] direction on Cu_3N-Cu(110) surface was observed [1]. The charge density of Cu(110) surface can be dramatically altered by terminating the surface with a (2x3) copper nitride (Cu_3N) layer. A proper understanding of the local electronic properties of the corrugated Cu_3N-Cu(110) molecular network and the atomic nanowires grown on this surface would be fundamentally important. We report here the low temperature (4.7 K) scanning tunneling spectroscopy (LT-STS) studies of both the Cu_3N layer and the Cu, Fe & Au atomic nanowires grown at room temperature on this surface. Constant height and constant current spectroscopy measurements have been carried out on the Cu_3N network and on the atomic nanowires. LT-STS studies on the Cu_3N surface show a band gap of >6.0 eV without any pronounced electronic state appearing in the spectra [2]. Tunneling spectroscopy measurements performed on the atomic nanowires of Cu, Fe & Au show appearance of two pronounced unoccupied electronic states at ~ 1.8 eV and ~ 3.8 eV. This observation will be discussed in view of the electronic structure of the Cu/Fe/Au-Cu_3N-Cu(110) system.

[1] X.-D. Ma, D. I. Bazhanov, O. Fruchart, F.Yildiz, T.Yokoyama, M.Przybylski, V.Stepanyuk, W. Hergert and J.Kirschner. PRL **102**, 205503 (2009)

[2] K. Bhattacharjee, X. –D. Ma, Y. Zhang, M. Przybylski and J. Kirschner, communicated Surface Science.