ELECTRONIC STRUCTURE AND CRYSTALLINE STRUCTURE OF VICINAL BERYLLIUM SURFACES

L. Walczak [1], V. Joco [2], G. Goryl [3], M.A. Valbuena [4], T. Balasubramanian [5], P. Segovia [1], M. Szymonski [3], and E.G. Michel [1]

[1]*Deparamento de Física de la Materia Condensada, Universidad Autónoma de Madrid, 28049 Madrid, Spain.*

[2]*Centro de Microanálisis de Materiales, Universidad Autónoma de Madrid, 28049 Madrid, Spain.*

[3] *Faculty of Physics, Astronomy and Applied Computer Science, Jagiellonian University in Krakow, Poland.*

[4] *Ecole Polytechnique Fédéral de Lausanne, Inst. de Physique de la Matière Condensée, Lausanne, Switzerland.*

[5]*MAX-Lab, Lund University, Lund S 22100, Sweden*

Keywords: vicinal surface, beryllium, angle resolved photoemission spectroscopy

**) e-mail: lukasz.walczak@uam.es*

A surface vicinal to a high-symmetry crystalline orientation is an interesting example of a one-dimensional nanostructured system. The case of noble metal surfaces vicinal to the (111) direction has been studied in detail in recent years [1,2]. It was found that the surface states are confined by the periodic step superlattice. Under adequate conditions, quantum well states are observed. Group II metals (like Be and Mg) exhibit several prominent surface states with a high density of states [3]. In the case of the (10-10) surface, there are different surface states, both for normal and off-normal emission (surface A point) [4].

The main objective of the present work is an investigation on the electronic properties of beryllium surfaces vicinal to the (10-10) direction using a low energy electron diffraction (LEED), Scanning Tunneling Microscope (STM), Angle Resolved Photoemission Spectroscopy (ARPES) with synchrotron radiation from I4 beamline at Maxlab. Lund. The sample long range order was confirmed by LEED, which showed superstructure spot splitting. The step superlattice was optimized by STM, that shows regular steps along [0001] direction. The electronic structure along steps (Gamma M surface direction) and perpendicular to steps (Gamma A surface direction) for several photon energies and for a range of different miscut angles was characterized. We identified several surface state bands, for both normal and off-normal emission (surface A point). The binding energy of the surface state at the surface A point depends on the crystal miscut angle, so that the surface state becomes slightly shallower than for a flat surface, as expected assuming a partial lateral confinement by the step superlattice. Concerning the surface state observed at normal emission, we find the appearance of additional subbands whose dispersion is compatible with lateral confinement induced by the step superlattice. The results for different miscut angles will be discussed and interpreted within this model.

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