MM 40: Topical Session Growth Kinetics I

Time: Wednesday 16:00–17:00 Location: H4

Topical Talk MM 40.1 Wed 16:00 H4

Modeling the Role of Co-deposited Impurities in Growth: What Causes the Distinctive Step Meandering and Pyramidal Mounds on Cu(001)* — •Theodore L. Einstein[1], Rajesh Sathiyanarayanan[1,2], Ajmi BH. Hamouda[1,3], and Alberto Pimpinelli[1,4] — [1]U. Maryland, College Park, USA — [2]Now at Pennsylvania State U., USA — [3]U. Monastir, Tunisia — [4]UBP-Clermont II, France, & Science Attaché, French Consulate, Houston, TX USA

Several attempts—not involving impurities—failed to account for all the distinctive features of the growth instabilities observed on Cu vicinal surfaces;[1] recent kinetic Monte Carlo studies showed that codeposition of impurities during growth could do so.[2] To identify the responsible impurity, we compute[3] nearest-neighbor binding energies (E_{NN}) and terrace diffusion barriers (E_d) for several impurity atoms on Cu(001) using VASP. Codeposition (with Cu) of mid-transition elements (Fe, Mn, W) could cause the observed instabilities; W is most likely. Based on E_{NN} and E_d, we classify the impurities into four sets.[3] Each set produces qualitatively different surface morphologies in both the step-flow and the submonolayer ($\theta \leq 0.7$ ML) regimes. In the latter, we find the variations with θ of the number of islands and their mean size, as well as their critical nucleus size from the distribution of capture-zone areas (via fits to the generalized Wigner distribution[4]).

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[1]N.Néel, T.Maroutian, L.Douillard, H.-J.Ernst, JPCM 15 ('03) S3227
[2]A. Hamouda *et al.*, PRB 77 (2008) 245430; JPCM 21 (2009) 084215
[3]RS, Ph.D. thesis, UMD, 2009 [4]AP & TLE, PRL 99 (2007) 226102

MM 40.2 Wed 16:30 H4

Rectangular mound formation and rotation during grazing incidence deposition of Cu/Cu(001) — •Herbert Wormeester, Raoul van Gastel, Frits Rabbering, and Bene Poelsema — Solid State Physics, MESA+ Institute for Nanotechnology, University of Twente, The Netherlands

We have studied the consequences of oblique incidence deposition for the morphology of the growth-front for a "prototypical" system Cu/Cu(001). Electron diffraction measurements and STM show that deposition at grazing incidence leads to the evolution of rectangular mounds, oriented *perpendicular* to the plane of incidence of the atom beam. At later stages, a transition towards rectangular mounds *parallel* to the plane of incidence is observed. To elucidate the mechanisms underlying the formation of anisotropic mounds and the rotation of the mounds, quantitative kMC simulations were performed, which support and predicted experimentally observed changes in mound orientation at later stages of growth. A close contact with experiment was established by using previously determined activation barriers for intra- and interlayer diffusion processes in the simulations. The latter describe accurately the observed morphologies in a wide range of temperatures (150-300 K) and coverages up to 40 ML. The simulations show that grazing incidence leads to a very rough growth front that can be characterized as Super Poisson roughening. The strongest roughening was found to occur just before the reorientation takes place. The layer distribution is also found to be markedly different from those obtained after normal incidence growth around this transition coverage.

MM 40.3 Wed 16:45 H4

Controlled Growth of Ternary Systems due to Plasma Enhanced Chemical Vapor Deposition (PECVD) Using Metalorganic Precursors — •Markus Neubert and Volker Buck — Department of Technical Physics, University of Duisburg-Essen, Lotharstrasse 1, 47057 Duisburg, Germany

Depending on the stoichimetric ratios the physical and chemical properties of ternary systems can vary considerably. These ratios can be adjusted by parameters of the deposition process.

Ternary systems of Ti_xSiC_y were deposited in a substrat temperature range from 400°C up to 800°C using a constant flux of two metalorganic precursors and different plasma powers. Analys of films was performed by Energy Dispersiv X-Ray Spectroscopy (EDX), Secondary Ion Mass Spectrometry (SIMS)and X-Ray Diffraction (XRD) with respect to stoichiometric ratios and structure of the films. Depending on both parameters variation of the stoichiometric ratio is possible. On a limited scale simutaneous modification of plasma power and substrat temperature can compensate each other.