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Effects of Deposition Dynamics on Thin Film Growth

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The dynamic effects, such as the steering and the screening effects during deposition, on an epitaxial growth (Cu/Cu(001)), is studied by kinetic Monte Carlo simulation that incorporates molecular dynamic simulation to rigorously take the interaction of the deposited atom with the substrate atoms into account. In the submonolayer range, the reported experimental results on the asymmetric island growth (van Dijken *et al.*, Phys. Rev. Lett. **82**, 4038 (1999)) is well reproduced. In addition, a salient phenomenon, the reversal of the asymmetry, is found as the island size increases and attributed to the asymmetric flux on the lower terrace of islands. [1]

As the thickness increases, we find three characteristic features of the surface morphology developed by the grazing angle deposition: (1) enhanced surface roughness, (2) asymmetric mound, and (3) asymmetric slopes of mound sides. Regarding their dependence on both deposition angle and substrate temperature, a reasonable agreement of the simulated results with the previous experimental ones is found. The characteristic growth features by grazing angle deposition are mainly caused by the inhomogeneous deposition flux due to the steering and screening effects, where the steering effects play the major role rather than the screening effects. Newly observed in the present simulation is that the side of mound in each direction is composed of various facets instead of all being in one selected mound angle even if the slope selection is attained, and that the slope selection does not necessarily mean the facet selection.[2]

The effects of the deposition dynamics is also studied for the thin film growth on a vicinal surface, Cu(1,1,17).It is found that the deposition flux becomes inhomogeneous in the step train direction and that the inhomogeneity depends on the deposition angle when the deposition is made along that direction. The steering effect is found to always increase the growth instability with respect to the case of homogeneous deposition. Further, the growth instability depends on the deposition angle and direction, showing a minimum at a certain deposition angle off-normal to the (001) terrace, and shows a strong correlation with the inhomogeneous deposition flux. The increase of the growthinstability is ascribed to the strengthened step Ehrlich-Schwoebel barrier effects, which are caused by the enhanced deposition flux near the descending step edge due to the steering effect.[3]

[References]

1. Jikeun Seo, S.-M. Kwon, H.-Y. Kim, and J.-S. Kim, Phys. Rev. B **67**, R121402 (2003).
2. Jikeun Seo, Hye-Young Kim, and J.-S. Kim, Phys. Rev. B (submitted).
3. Jikeun Seo, Hye-Young Kim, and J.-S. Kim, Phys. Rev. B **71**, 075414 (2005).