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Local surface structure and composition determination by low-energy electron microscopy and Monte Carlo simulation JIEBING SUN, Univ. of New Hampshire, JAMES B. HANNON, IBM Research Center, GARY L. KELLOGG, Sandia National Labs, KARSTEN POHL, Univ. of New Hampshire — It has been long pursued to accurately measure surface structure and composition with high temporal and spatial resolutions. Modern surface analytical techniques, however, either have to assume a homogeneous surface structure, or have only a very limited sensitivity to subsurface or chemical composition. We have developed a novel analysis technique to overcome these limitations [1-2]. We are able for the first time to measure a complete 3D composition map of the first three surface layers in real time by analyzing low-energy electron microscopy imaging intensity dynamically. We have demonstrated that a lateral spatial resolution of about 8.5 nm can be achieved to unravel the origin of the heterogeneous PdCu surface alloy grown on a Cu(001) substrate. A fundamental step-overgrowth mechanism has been identified to be responsible for the heterogeneity developing around steps, a generic mechanism relevant to many thin-film systems. Furthermore, Monte Carlo simulations indicate that the favorable NN Pd-Cu bonding is responsible for the heterogeneity in the PdCu system and not a slow diffusion process. [1] J. B. Hannon *et al.*, Phys. Rev. Lett. 96, 246103(2006) [2] J. Sun *et al.*, Phys. Rev. B (scheduled for publication 15 Oct 2007)

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