

Physics Colloquium Series

“High Resolution Surface Microscopy of Chemical Reactions and Phase Transitions”

We have used scanning tunneling microscopy to investigate the behavior of furan (C₄H₄O) adsorbed on Pd(111) at 225 K, as well as aspects of its decomposition after heating to 415 K. Our observations support a furan decomposition mechanism wherein furan preferentially adsorbs and reacts at upper step edge sites. Ab initio calculations based on Hohenberg-Kohn density functional theory (DFT) have been performed for several high-symmetry adsorption sites of furan on flat Pd(111) and show distortions of both the furan and the top layer of Pd upon adsorption, with predicted theoretical STM images agreeing well with the data. Using the Low Energy Electron Microscope (LEEM), we have also studied phase transitions on the Pb/Ge(111) surface, for which we have discovered a novel phase separation during the $\beta \leftrightarrow (1 \times 1)$ phase transition. For Pb coverage just under 1.33ML, β and (1X1) phases coexist for a range of temperatures, and the transformation occurs from 232°C to 181°C. When the coverage is again reduced by ~0.01ML, a dramatic change in the transformation happens, with small domains of the new phase appearing and disappearing, due to fluctuations between the two phases. We attribute the fluctuating domains to thermal fluctuations in the density of Pb atoms within a domain.

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4:00-5:20 PM MND 1015

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