Physics at the borderline between 1D and 2D

Workshop of the Nanowire Network in Bad Honnef

13-15 February 2013

organized by

FOM-1D, FOR1162, FOR1700

NWO

DFG Deutsche Forschungsgemeinschaft

Strain- and electronically stabilized low dimensional systems studied by LEEM

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Abstract

The self-organization of two-dimensional films into distinct patterns can result from a variety of physical forces. Patterns stabilized by elastic, electrostatic or magnetic forces are commonly found in literature. Low energy electron microscopy (LEEM) directly visualizes the patterns and allows both qualitative and quantitative information to be obtained from LEEM images and their spectroscopic variants.

In this presentation I will highlight the unusual behavior of Bi adlayers on Cu(111) and Ni(111) surfaces. On Ni(111) quantum well states exist between the vacuum interface of the film and that formed by a Bi wetting layer [1]. Surprisingly, films of different thickness yield different structures. The origin of this electronically induced variation of the atomic structure is found to reside in the variation of the Fermi wavelength for different film thicknesses and structures.

On Cu(111) on the other hand, elastic forces between different phases formed by the Bi dominate, and a strain-stabilized pattern is observed [2]. The morphology of the pattern undergoes a distinct transition at a temperature of 680 K. Using the diffracted intensity in LEEM images, the nature of this transition could be traced back to an order-disorder transition that occurs in one of the two Bi phases that constitute the self-assembled domain pattern.

[1] T.R.J. Bollmann, R. van Gastel, H.J.W. Zandvliet, and B. Poelsema,
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[2] R. van Gastel, D. Kaminski, E. Vlieg, and B. Poelsema,
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