Direct observation of metastable organic layer growth: Transition from Stranki-Krastanov to Frank-van der Merwe

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The understanding of the growth properties like growth mode, crystal structure, dislocation density, etc., is of general interest for heteroepitaxy. Significant progress has already been made in the understanding of thin film growth of metals and semi-conductors, e.g. the growth mode can be tuned by suitable surfactants or interfactants. However, there is a substantial lack of experimental and theoretical descriptions of the growth dynamics of thin film of large aromatic organic molecules on metallic substrates. The reason for this are manifold: the molecular thin films have large unit cells which cover many substrate atoms (> 20), the intermolecular interactions are strongly anisotropic and the thermal expansion coefficients may vary by one order of magnitude.

Recent PEEM measurements of PTCDA on the Ag(111) surface have directly shown the growth mode transition from *quasi* layer-by-layer to Stranki-Krastanov at about 350 K. This transition is associated to the presence of metastable layers during and after growth [1]. The systematic observation of different decay modes for metastable layers and the instauration of steady-states between the metastable layers and 3-dim islands are discussed and correlated to the growth mode transition. We suggest a model based on the two crystalline structures for the 3-dim islands and the multilayers in combination with diffusion processes [2] to describe the presence of the metastable layers and the growth mode transition.

[1] H. Marchetto, Th. Schmidt, U. Groh, R. Fink, H.-J. Freund and E. Umbach, in preparation.

[2] H. Marchetto, U. Groh, Th. Schmidt, R. Fink, H.-J. Freund and E. Umbach, Chemical Physics 325 (2006) 178-184.