X-Ray Spectromicroscopy Studies of the Effect of Chain Length and Substrate Temperature on the Growth and Morphology of n-Alkane Thin Films

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X-ray microscopy has been used to study the morphology and growth of thin films of linear n-alkanes prepared by vacuum evaporation onto freshly cleaved NaCl(001) surfaces, where molecules can align along the [110] and [-110] directions on the NaCl(001) surface.

X-ray microscopy experiments were performed using the Scanning Transmission X-ray Microscopes (STXM) on beamlines 5.3.2 and 11.0.2. at the Advanced Light Source (ALS). NEXAFS microscopy at the Carbon K-edge reveals that the morphology and orientation of these vapor deposited n-alkane thin films changes systematically with the chain length and the substrate temperature during deposition. Figure 1 presents STXM images for hexacontane (HC, $C_{60}H_{122}$) deposited onto the NaCl(001) surface at different substrate temperatures recorded at 287.6 eV (e.g. C1s $\rightarrow \sigma^*_{C\text{-}H}$ transition). These images show strong contrast, attributed to *different molecular orientations* of the different domains. The size of the domains depends on the deposition substrate temperature, an effect that can be attributed to the increased molecular mobility and a decreased crystal nucleation density during growth at elevated substrate temperatures. Complementary phenomena are observed when the chain length of the n-alkane molecules is varied.

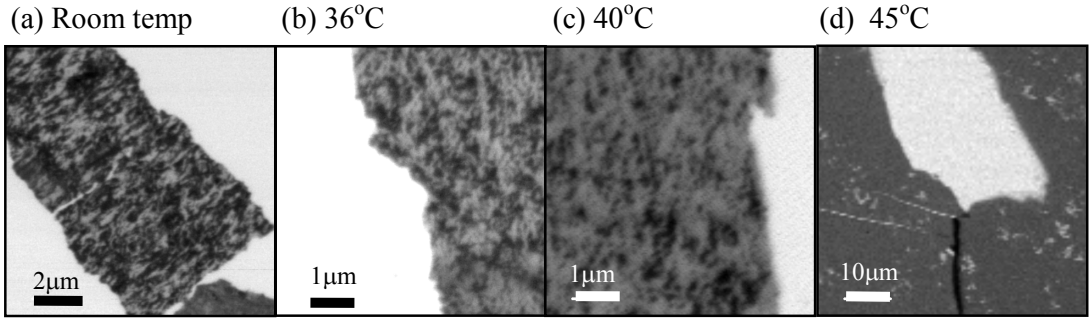

Figure 1. X-ray microscope images of hexacontane ($C_{60}H_{122}$) deposited onto NaCl(001) surfaces at different substrate temperatures. These images were recorded with a x-ray energy of 287.6 eV corresponding to the C 1s → C-H transition.

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