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Incorporation-limited growth of molecular film: Zn-phthalocyanine on Ag(100)[1] JERZY SADOWSKI, ABDULLAH AL-MAHBOOB, Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, NY 11973 — Metal phthalocyanines draw considerable attention due to their potential for energy and environmental applications. However, the control of film fabrication, necessary for achieving optimized performance of organic devices, remains a challenge. Here, we present results of low-energy electron microscopy (LEEM) studies of incorporation-limited growth mechanism of zinc-phthalocyanine (ZnPc) thin films on Ag(100) substrate. We found that when ZnPc is deposited on a substrate kept at lower temperature (RT to 430K), the resulting film has a double domain epitaxial structure, resembling that of bulk ZnPc, with domain sizes in the sub-micrometer range. At above 440K, the film ordering changes into a 5x5 commensurate structure, having only a single crystalline orientation. In situ LEEM of the nucleation and growth of the film allowed us to find a crossover of equilibrium concentration of diffusing molecules versus temperature for both adsorption phases, and thus to tune the type of nucleation. We determined that at favorable growth conditions, the 5x5 phase undergoes a thermodynamic phase transition into the bulk-like structure and we were able to obtain ZnPc bulk-like films with unprecedented quality, with single crystalline domain sizes in the range of millimeters.

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