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Growth of pentacene on inorganic and organic dielectrics and submicron channel oTFT fabrication[1] G. LEISING, B. STADLOBER, U. HAAS, A. HAASE, H. GOLD, Joanneum Research / Inst. of Nanostructured Materials and Photonics — We have fabricated pentacene thin films on different organic and inorganic dielectrics at four substrate temperatures with different film thicknesses ranging from the submonolayer over the multilayer to the "thick" film regime. These films were characterized by AFM and analyzed by means of scaling and rate equation theory in order to deduce the molecular growth dynamics. We found that on all substrates and in a certain substrate temperature range the growth can be well described as diffusion-limited aggregation. A critical island size was deduced from the scaling of the distribution density of the grain areas and the power-law dependence of the saturated nucleation density on the deposition rate. OTFTs with a channel length down to 300 nanometers have been fabricated by nanoimprint-lithography, using stamps made by e-beam-lithography and reactive ion etching. Due to a combination of different effects these transistors show high quality electrical characteristics. In conclusion, we observed no principal limitation for the downscaling of pentacene-based oTFTs due to short channel effects concerning all relevant parameters such as threshhold voltage, mobility, on-current and on-off ratio as long as the morphology is characterized by large and well-ordered crystallites.

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