

The growth of organic ultra-thin films on silicon oxides with variable vacancy states: a Scanning Force Microscopy approach

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The master equation ruling the growth of organic films was proved by using the activation energy and the substrate temperature. Ultra-thin films of sexithiophene (6T) were grown on Si/SiO_x (native) substrates with increasing resistivity ρ from 0.0015 to 1000 $\Omega \cdot \text{cm}$. As shown by topographic images, organic films are composed of 6T islands (i.e. sub-monolayer regime) whose morphology is influenced by ρ . Surface coverage, shape, fractal dimension and height were used to probe the film growth mode. In particular, the fractal dimension D_f hints a Volmer-Weber growth mode for the highest ρ , which evolves into a Stranski-Krastanov one for the lowest ρ . The D_f evolution is non-monotonic, showing a maximum for mean resistivity (1-10 $\Omega \cdot \text{cm}$) where the film follows the layer-by-layer growth mode (Frank-van der Merwe). By means of ρ , the substrate surface energy (i.e. the molecular diffusion energy E_d) has been systematically varied for describing the master equation together with the activation energy E_N . These results are correlated to the decreasing of SiO_x vacancy states for increasing ρ , underlying also the key role of electrostatic interactions in the nuclei formation.