NanoLab Talk

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Organic ultra-thin films grown on native 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 [1]. Ultra-thin films of sexithiophene (6T) were grown on Si/SiO_x (native) substrates with increasing resistivity ρ from 0.0015 to 1000 Ω·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 [2] 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 (1-10Ω·cm) where the film follows the layer-bylayer 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 [3], underlying also the key role of electrostatic interactions in the nuclei formation.

References

[1] F. Dinelli *et al.* J. Phys. Chem. B 110, 258 (2006)
[2] F. Valle *et al.* Micron 100, 60 (2017)
[3] W.B. Ying *et al.* Appl. Surf. Sci. 181, 1 (2001)

About the speaker:

Dr. Cristiano Albonetti is a CNR research scientist joining to the Research Division on "Nanotechnology of Multifunctional Materials" at the CNR Institute for the Study of Nanostructured Materials (ISMN, Molecular Design Department). He obtained a degree in Condensed Matter Physics in 2001 at the Department of Physics, University of Bologna, and a PhD in Physics in 2005. He performs experimental research activities on scanning probe microscopy techniques (especially morphological and electrical); physics of organic films growth; physical modelling of the tip-surface interactions; fabrication and characterization of hybrid electronic devices such as organic field-effect transistors; fast and parallel techniques for nanostructures fabrication (he has one patent right on this topic).

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