POLITECNICO DI MILANO

NanoLab

NanoLab Talk

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Seminar Room 1° floor

Department of Energy – Cesnef (Building 19) via Ponzio 34/3 Milan

Politecnico di Milano

"Solid-like transition of ionic liquids in nanostructured carbon thin films"

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Abstract:

A wide potential for applications coupled to favourable environmental properties have made room temperature ionic liquids (ILs) one of the most extensively investigated topics in chemical physics of the last few years. The viability and eventual impact of several among the proposed applications, including electrochemistry and heterogeneous catalysis, strictly depend on the properties of ILs at the interface with solid phases. Interfacial properties play an even larger role in applications such as lubrication, in which ILs are confined in a narrow space in between solid surfaces.

To date little is still known about the interfacial properties of very thin films of ILs supported by flat or nanostructured solid surfaces. Understanding the combined effects of surface interactions, presence of water in solution, long range electrostatic forces, confinement on the structural rearrangement and on the interfacial properties of supported ILs films is a challenging task, which requires theoretical, computational, and experimental efforts.

I present the results of an experimental study of the morphological and structural properties of thin films of 1-Butyl-3-methylimidazolium Bis(trifluoromethylsulfonyl)imide ([bmim][Tf2N]) deposited in methanol, with very low concentration, by drop-casting on HOPG and on nanostructured carbon thin films deposited by Supersonic Cluster Beam Deposition. Atomic Force Microscopy (AFM) studies, including high-resolution imaging and nanomechanical tests, have been carried out on thin IL layers. Ordered lamellar nanostructures of mesoscopic area (1–100 μm2) with a vertical structural periodicity have been observed at room temperature on the nanostructured carbon, while they are not observed on HOPG surfaces. Nanomechanical investigations reveals that these structures resist to normal compressive loads up to few hundreds of MPa. Beyond that limit, indentation occurs in discrete steps: this observation suggests a solid-like character of the islands

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