NCAFM imaging at room temperature of electrosprayed molecules

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Adsorption of molecules (isolated or assemblies) on surfaces under ultra high vacuum (UHV) conditions is an important field in nanoscience and lead to many applications such as photovoltaics, molecular electronics or surface functionalization. In order to study complex molecules that could be used in such devices, an alternative method to thermal evaporation has to be used. The main reason is that with thermal evaporation, sublimation temperature increase with the size of molecules and the fragmentation of the molecules can occur before this sublimation temperature is reached.

Here we present adsorbed molecules imaged with NCAFM but deposited with an optimized electrospray system [1,2] based on ElectroSpray Ionization (ESI) [3]. ESI allows to introduce, in UHV, large organic molecules that are initially present in solution. A high voltage, is applied between the solution in a syringe and the entrance to UHV, a capillary. As a result, droplets containing the studied molecules and the solvent are introduced in UHV through a differential pumping system. Coulomb fission of the droplets combined to their pumping allows to obtain a flux of the molecules directed to the sample with a typical pressure in the sample chamber during deposition of 5.10^{-8} mbar.

Our measurement were based on the deposition and NCAFM imaging of different large organic molecules on various surfaces, mainly Cu(111) and ionic crystals [Fig]. The electrospray system is mounted to a room temperature non contact atomic force microscope (NC-AFM) where the images of the surfaces are obtained. We will show that this two combined apparatus allows to image large organic molecules with a high resolution at room temperature.

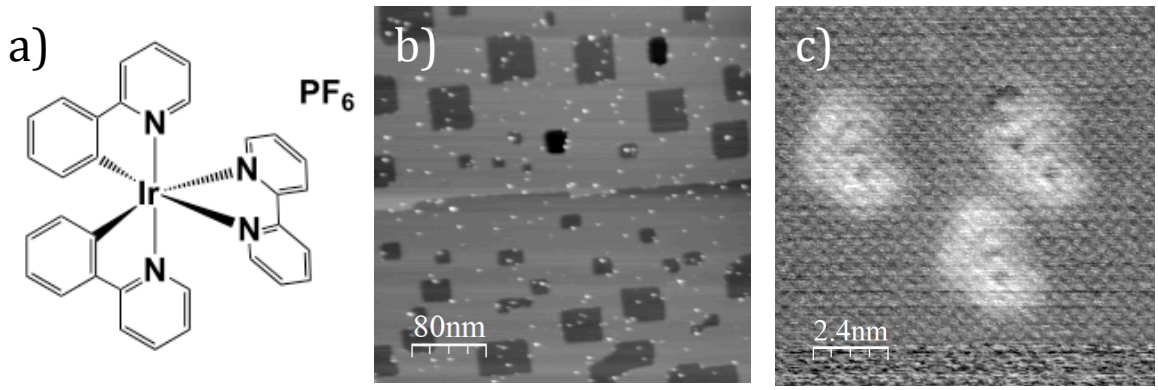

Fig : a) ion transition metal complex (iTMC) molecule that can be spray deposited. b) Large scale topograpy image of the iTMC molecules on the KBr(001) surface. c) Topography image of 3 isolated iTMC molecules.

References:

[1] http://www.molecularspray.co.uk/index.htm
[2] Satterley C J et al., 2007, *Nanotechnology,* **18,** 455304
[3] Fenn J B et al., 1989, *Science,* **246,** 64-71