FABRICATION OF LARGE CRYSTALLINE MONOLAYERS OF NANOGRAPHENES BY "SOFT LANDING" TECHNIQUE

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The processing of giant macromolecules into ultrapure and highly ordered structures at surfaces is of fundamental importance to study chemical, physical and biological phenomena, as well as for their use as active units in the fabrication of hybrid devices. The possibility of handling larger and larger molecules grants access to increasingly complex functions. Unfortunately, larger molecules usually imply lower processability due to either their low solubility in liquid media or the occurrence of thermal cracking during vacuum sublimation. The search for new strategies to process and characterise giant molecules is thus a key goal in materials science. Here we report a new general route to process at surfaces extraordinarily large molecules, i.e. synthetic nanographenes, into ultrapure crystalline architectures.[1] Our method relies on the soft-landing of ions generated by solvent-free matrix assisted laser desorption/ionization (see figure 1). The nanographenes are transferred to the gas phase, purified and adsorbed at surfaces. Scanning tunnelling microscopy (figure 2) revealed the formation of ordered nanoscale semiconducting supramolecular architectures. The unique flexibility of this method allows growth of ultrapure crystalline films of various systems, as organic, inorganic and biological molecules, hence it can be of interest for applications in electronics, (bio)catalysis and nanomedicine.

References:

[1] H. J. Rader, A. Rouhanipour, A. M. Talarico, V. Palermo, P. Samori and K. Mullen "*Processing of giant graphene molecules by soft-landing mass spectrometry*", Nature Materials; **5**, 276 (*2006*).

Figures:

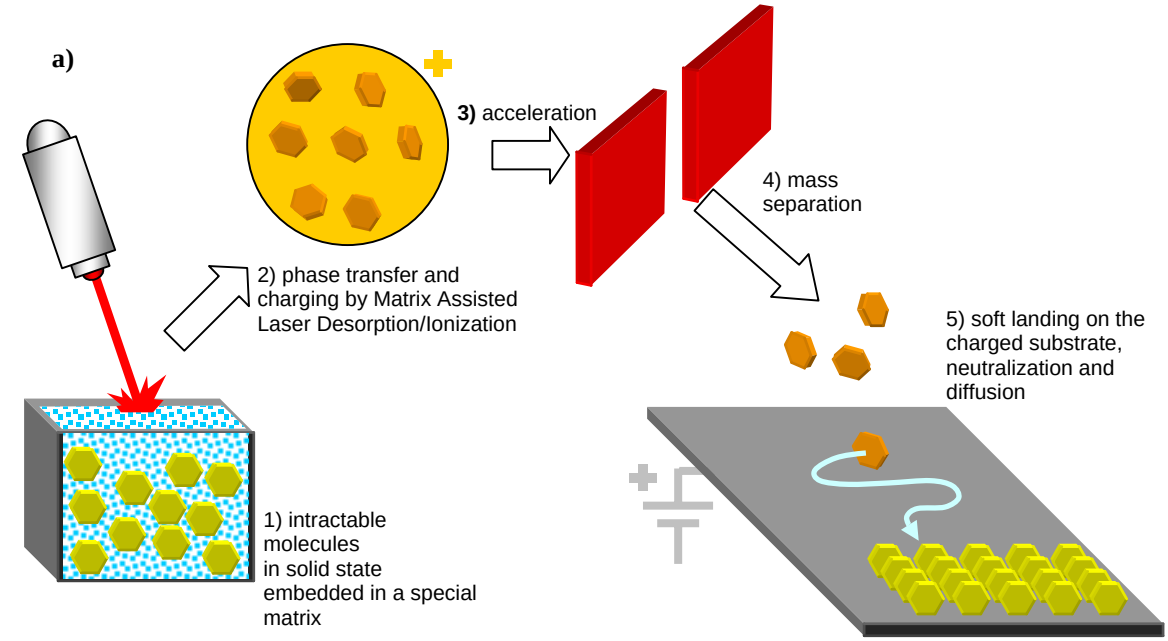

Fig. 1 The soft landing technique.

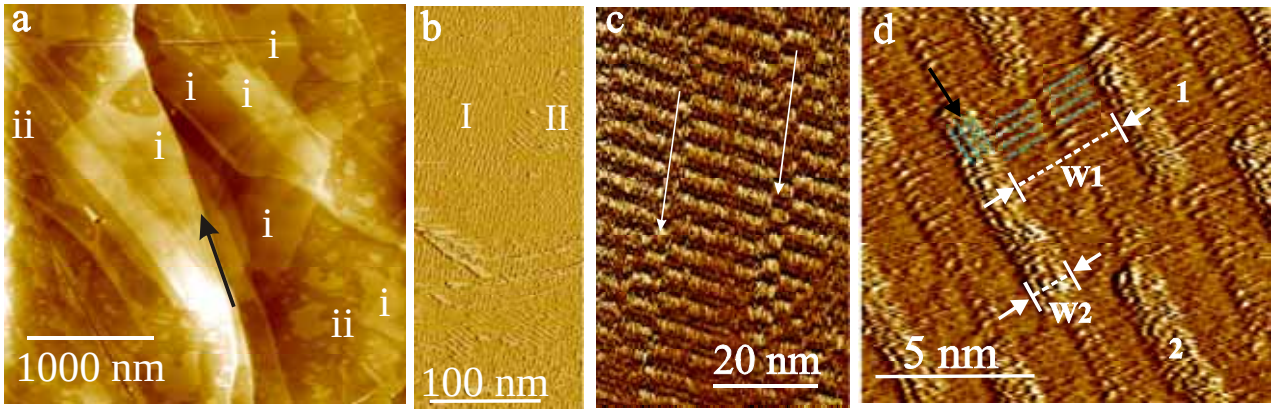

Fig. 2 $C_{42}H_{18}$ layer soft-landed on HOPG: (a) SFM topographical image. Z-scale of the image amounts to 8.6 nm. (b-d) Current STM images: (b) Polycrystalline structures composed of different domains with a given lamellar orientation are marked with different numbers. (c) Magnified region of domain I from (b). The image in (d) has been corrected for the piezo drift. The two types of phases (1,2) are indicated. The molecular structure from the CPK representation has been drawn on the top of the STM image. Tunneling parameters: (b,c) bias tip voltage U_t=446 mv, average tunneling current I_t= 8 pA. (d) U_t=653 mv, I_t= 12 pA.