Uncoventional Bottom-Up Approach To Nanofabrication Of Functional Materials

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Here we present how a bottom-up nanofabrication technique, recently developed in our group, improves charge transport and crystallinity of thin solid films via nanostructuration. The process, termed lithographically controlled wetting [1] (LCW), allows us to pattern soluble materials with nanometer-sized structures in single step and in a few seconds. We demonstrate patterning nanostructures like droplets, stripes and fibers, with size feature less than 100 nm, for a variety of materials relevant to organic electronics: conjugated oligomers and polymers, liquid crystals, molecular magnets and spin crossover compounds [2] and bio-materials. We show how the nanostructuration by LCW can induce self-organization.
In the second part we demonstrate a direct application of our technique on field effect transistor where current flows through an array of naostripes stripes [3], whose height is few-monolayers and width 180 nm, made of well-ordered semiconductor molecules, viz. oligofluorene. The stripes are formed across the channel of the transistor by self-organisation driven of the molecules in a solution confined under the protrusions of a stamp by the capillary forces. Each stripe is formed by few coherent domains and it is electrically connected to the electrodes. The charge mobility in the nano-stripes is at least two orders of magnitude larger than that measured on solution-cast thin film devices, and one order of magnitude larger than that measured in high-vacuum-sublimed thin films.

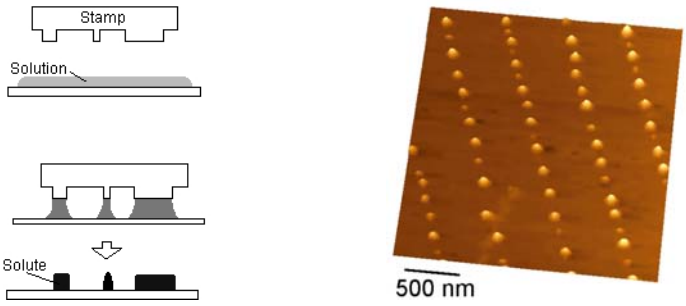

Figure (Left) Scheme of lithographically controlled wetting and (Right) patterning of molecular magnets by LCW and dewetting.

[1] M. Cavallini, F. Biscarini, *Nano Lett.* **3,** 1269, (2003)
[2] M.Marchive et all. *J. Am. Chem. Soc.* **124,** 194, (2002).
[3]M. Cavallini, P. Stoliar, J.F. Moulin, M. Surin, P. Leclère, R. Lazzaroni, D. W. Breiby, J.W. Andreasen, M. M. Nielsen, P. Sonar, A. C. Grimsdale, K. Müllen, F. Biscarini. *Nano Lett.* **5,** 2422(2005).