Molecular self-assembly scales up from nanometers to millimeters

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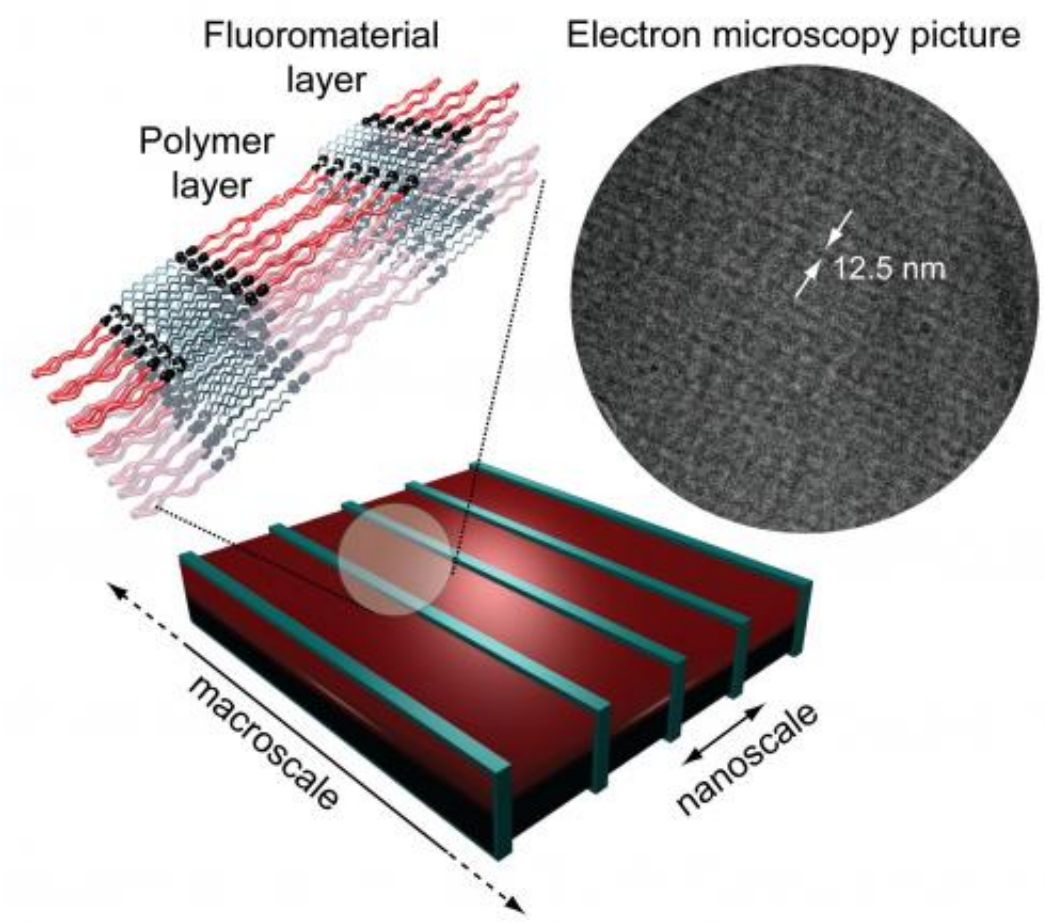

Self-assembled nanostructure keeps aligned up to millimeters

Can self-assembly based technologies offer advantages beyond conventional top-down lithography approaches?

To ensure the survival of Moore's law and the success of the nanoelectronics industry, alternative patterning techniques that offer advantages beyond conventional top-down patterning are aggressively being explored.

A joint effort of the Aalto University of Helsinki, the Politecnico di Milano, and VTT Technical Research Centre of Finland has now demonstrated that it is possible to align molecular self-assemblies from nanometers to millimeters without the intervention of external stimuli.

Molecular self-assembly is a concept derived from Nature that leads to the spontaneous organization of molecules into more complex and functional supramolecular structures. The recipe is "encoded" in the chemical structure of the self-assembling molecules. Molecular self-assembly has been exploited for "templating" functional devices, molecular wires, memory elements, etc. However, it has typically required additional processing steps to achieve extended alignment of the structures.

The new finding showed that by engineering recognition elements between polymers and fluorinated small molecules, it has been possible to drive their spontaneous self-assembly from nanometers to millimeters, thanks to the judicious use of noncovalent interactions. After the processing, fluoromolecules can optionally be removed upon thermal treatment.

This concept opens up new avenues in large area nanoconstruction, for example in templating nanowires, which is currently under investigation.

More information: "Halogen-bonded mesogens direct polymer self-

assemblies over millimetre length scale" N. Houbenov, R. Milani, M. Poutanen, J. Haataja, V. Dichiarante, J. Sainio, J. Ruokolainen, G. Resnati, P. Metrangolo, and O. Ikkala, , *Nature Communications* 5:4043, DOI: 10.1038/ncomms5043 (2014).
www.nature.com/ncomms/2014/140 … full/ncomms5043.html

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