

**TEMPLATE DIRECTED SELF-ORGANIZATION OF SOFT MATERIALS**X.Zhang<sup>1,2\*</sup>, H.P. Xu<sup>1</sup>, M.F.Wang<sup>1</sup>, F.Shi<sup>1</sup>, H.Y.Zhang<sup>1</sup> & Z.Q.Wang<sup>2</sup><sup>1</sup>*Key Lab of Supramolecular Structure & Materials, Jilin University, Changchun 130023, P. R. China.*<sup>2</sup>*Department of Chemistry, Tsinghua University, Beijing 100084, P. R. China.*

**INTRODUCTION:** Self-organization of soft materials such as amphiphile, dendrimer and polyelectrolytes can be exploited to create diversified structures of technological importance. By deliberately designing the soft materials and choosing the template and conditions, we are able to confine the soft materials in two-dimensional space for development of patterning chemistry and nanostructured materials. Till now, ways of self-organization for pattern formation is greatly restricted in utility, since the size and shape of such a structure is determined by the chemical and physical forces that directs its formation rather than by the requirements of its end application. However, this research is of significance as the method of choice for fabricating various thin film-based devices and sensors using nanoscale patterns in the size range of 1 to 10<sup>2</sup> nm with controlled composition and molecular orientation [1].

**METHODS:** AFM images of interfacial micelles were captured in situ (tapping mode in fluid) and ex situ (tapping mode in air) on mica substrate and STM images of self-assembled monolayers(SAMs) were taken on gold slide using commercial instruments Nanoscope IIIa AFM Multimode™ (Digital Instrument, CA). Surface-bound dendrons were synthesized through convergent method.

**RESULTS & DISCUSSION:** To combine the electrostatic layer-by-layer assembly and photochemical reaction, we have fabricated photosensitive multilayer thin film by alternating deposition diazo-resins and poly(acrylic acid), and then by taking advantage of the different solubilities of the multilayers prior and after UV irradiation, in a proper solvent, patterned surfaces with designed lateral structure are obtained. This patterned surface can be modified further more and used as a temple for selective adsorption of different functional species [2].

Microporous surface can be also obtained interestingly by post-treatment of the hydrogen-bonding-directed multilayers of poly(4-vinylpyridine) and poly(acrylic acid) in base solution. A two-step mechanism is proposed and confirmed: the first step is the dissolution of poly(acrylic acid) from the film into the basic

solution; the second is the gradual reformation of poly(4-vinylpyridine) remaining on the substrate, producing a microporous film [3].

Going down in scale, we have taken advantage of the interfacial aggregation properties of a series of bolaform amphiphiles bearing mesogenic groups to form cylindrical or wormlike surface micelles that are stable against drying [4]. The enhanced stability can be attributed to the strengthened interaction due to the introduction of mesogenic groups and long spacers in the bolaform amphiphiles. The confined geometries of the surface micelles can be fine-tuned by changing factors e.g. chemical structures of the bolaform amphiphiles, substrates, and ionic strength.

To form different structures on the nanometer scale, we have used surface-bound polyether dendrons as nanobuilding blocks for chemisorption onto gold-covered slides [5]. By the precise control of the periphery groups of the surface-bound dendron-thiols, we have obtained surface structures with controlled morphology: heptane chains appear to enhance the interaction between symmetrical backbones, leading to the formation of stripes, while oligo(ethylene oxide) chains appears to weaken the interaction between symmetrical backbones, resulting in a homogeneous structure. Dendrons with both heptane and oligo(ethylene oxide) chains exhibit nanophase separation in a confined state, leading to formation of a honeycomb structure. It has shown clearly that the periphery structure can determine the surface organization.

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