Carbohydrate-based Block Copolymer Self-Assemblies: Highly Nanostructured Thin Films and DSA Patterning

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Current knowledge in modern molecular science allows for the preparation of a myriad of tailored nanomaterials, which play important and multifaceted roles in nanoscience and technology. Among the bottom-up strategies, self-assembly is an incredibly powerful concept in macromolecular engineering that offers an invaluable tool for the preparation of 2D and 3D discrete nanostructures, ranging from materials science to molecular biology, which are often not accessible by any other fabrication process. Using self-assembly as a synthetic tool, powerful chemistry and physico-chemistry protocols can be developed that are capable of organizing organic and inorganic building-blocks into unprecedented structures and patterns, over several length scales to create novel and innovative materials.

In this context and during the last decades, block copolymers (BCP) systems have received considerable attention as a promising platform for preparing nanometer-scale structures and materials due to their self-assembling nature into periodic domains whether in solution or solid states. Currently, one of the major challenges in this field is to find copolymers that could address sub_10 nm pattern size.

To date, numerous studies have been focused on the self-assembly of petroleum-based BCPs for potential applications in multidisciplinary fields, such as nanoparticles for drug delivery, or nano-organized films for biosensors, or nanolithography, etc. Such materials are derived from fossil resources that are being rapidly depleted and have negative environmental impacts. In contrast, carbohydrates are abundant, renewable and constitute a sustainable source of materials. This is currently attracting much interest in various sectors and their industrial applications at the nanoscale level will have to expand quickly in response to the transition to a bio-based economy. The self-assembly of carbohydrate BCP systems at the nanoscale level via the bottom-up approach, has allowed only recently the conception of very high-resolution patterning (thin films with sub_10nm resolution) that has never been attained to date by petroleum-based molecules and provides these new materials with novel properties such as: New generation of Nanolithography, Memory devices, OPV, high resolution Biosensors,…

We will present recent results on the self-assemblies of carbohydrate-based block copolymer leading to highly nanostructured thin films (sub-10nm resolution) using DSA approach in combination of solvent and/or thermal annealing as well as new and ultra-fast microwave "cooking" approach".

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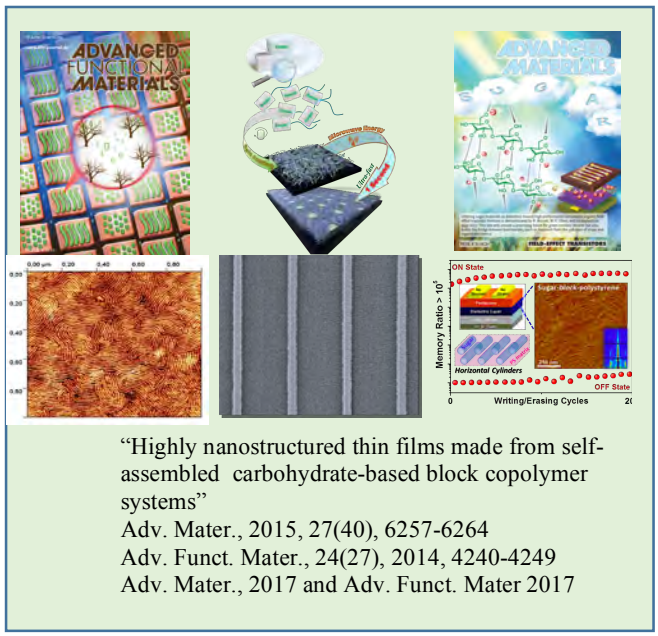

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