New Functional Nanomaterials based on Block Copolymer Self-Assembly

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Two types of nanoporous templates, nanoporous block copolymer membranes and anodized aluminum oxide membranes (AAO), have been widely used for the development of new functional nanomaterials suitable for advanced membranes, electronics, optics, magnetism, and energy storage materials.

We prepared nanoporous templates by using thin films of mixtures of polystyrene-block-poly(methyl methacrylate) (PS-b-PMMA) and PMMA homopolymers. These templates have cylindrical nanoholes spanning the entire thickness of the film. The nanoporous films were found to be very effective for the filtration of human Rhinovirus type 14 (HRV 14), major pathogen of a common cold in humans, from the buffer solution.1 We found that when the pore size was effectively controlled down to 6 nm, single file diffusion, namely, the constant drug release with time, was observed up to 2 months.2

Also, when we fabricated functionalized nanochannels by using carboxylic acid terminated PS-b-PMMA, the nanochannel wall could be effectively used for immobilization site for molecular recognition agents (MRAs).