Multiscale Architectured Polymeric Membranes with Tunable Separation Properties

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In this presentation, we suggest multiscale porous membranes that allow for high permeation flux without sacrificing separation efficiency. In order to create the multiscale architectured membranes, primary structure is first prepared by assembling closely packed colloidal particles, filling the gaps with a suitable material, and dissolving out the particles to form inverse opal structure. Then, secondary nanostructures are incorporated inside the structured template to elaborately tune the pore size, tortuosity, and interfacial properties. Embedded nanostructures can be created by layer-by-layer assembly of polyelectrolyte multilayers, microphase separation of block copolymers, or self-assembly of another colloidal particles, etc. Finally, the constructed multiscale architectures are utilized for water-treatment applications, such as ultrafiltration of nanoparticles or nanofiltration of metallic ions. Due to the perfectly ordered characteristics of the multiscale architecture, it offers advantages of reduced tortuosity as well as pore size uniformity, resulting in high permeability and selectivity simultaneously.