Ultrafiltration Membrane Employs Heat and Chemical Resistant Crosslinking Block Polymers

Technology #20170252

Heat Resistant Polymer with Continuous Pores and Narrow Pore Size Distribution

A new method creates polymeric materials with a disordered, bicontinuous morphology and a narrow pore size distribution that enables facile mass transport and high size-selectivity with fewer post-processing steps. The procedure crosslinks a block copolymer above the order-disorder transition to kinetically trap the disordered, bicontinuous morphology associated with composition fluctuations. One block is then selectively etched to produce a nanoporous material. The order-disorder transition temperature (TODT) of the block copolymer can be adjusted to the temperature window where the crosslinking agent is stable and unreactive, so the crosslinking reaction can selectively be initiated when the system adopts the disordered, bicontinuous morphology associated with composition fluctuations. The flexible design produces heat resistant materials with continuous pores and narrow pore size distributions, and the polymeric nature of the precursor allows solution processing prior to cross-linking. This method shows good potential for applications in chemical separations, fabrication of membranes and surface coating of existing membranes.

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Better Nanoporous Membrane Preparation Method

Current methods to prepare nanoporous membranes from block copolymers are expensive, require tedious post processing, can result in broad pore size distributions and suffer from limited applications. This new, straightforward method offers a process to obtain materials with a disordered, bicontinuous morphology that allows good mass transport while the thermoplastic nature of the uncross-linked precursors ensure good processability of the system (extrusion, injection molding, and coating methods). The process results in excellent control of pore size distribution (typical of systems based on block copolymers), good mass transport resulting from a bicontinuous porous structure (typically obtained with the phase inversion and polymerization induced microphase separation (PIMS) approaches) and excellent processability typical of thermoplastic systems. It can be used either as a polymer melt (extrusion, injection molding) or in solution for application in thin-film technology (spin-coating).

**BENEFITS AND FEATURES:**

- Heat resistant
- Excellent control of pore size and pore size distribution
- Compatible with traditional processing methods
- High flux and selectivity
- Disordered, bicontinuous morphology

**APPLICATIONS:**

- Polymer membrane applications
- Separation and filtration, ultrafiltration (e.g., water)
- Chemical separations
- Fabrication of membranes
- Surface coating of existing membranes

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Phase of Development

Proof of Concept. Materials synthesized and characterized; porosity and morphology verified; membrane fabrication demonstrated.

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