



Nanoporous Polymeric Materials Produced by Crosslinking Block Polymers above Order-Disorder Transition

Nanoporous polymeric membranes are useful for fluid filtering operations and are used in a wide variety of applications requiring selective removal of pathogens and chemicals and generating ultrapure water. Current methods of preparing nonporous membranes from block copolymers are expensive, require tedious post processing and can result in broad pore size distributions with poor selectivity and limited applications.

Description of the Invention

A new, straightforward method offers a process to obtain polymeric 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 novel method creates 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 involves crosslinking 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 (T_{ODT}) 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.

Features and Benefits

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

Potential Applications

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

Technology Status

Proof of Concept. Polymers characterized.

Publications

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IP Status

Patent Pending

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