Phase separation-based fabrication methods for mesoporous polymers

Keywords: commercial polymer, phase separation, porous material, separation function, nanofiber, crystallization, processing, pore structure characterization

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Background

- Fabrication methods of porous polymers beneficial for industrial applications
- Product examples: separator, gas separation membrane, hollow fiber membrane, adsorbent, thermal insulators, shock absorbers, acoustic absorbers, dessicant, ...
- Various fabrication methods demanded depending on polymers, material shapes, ...

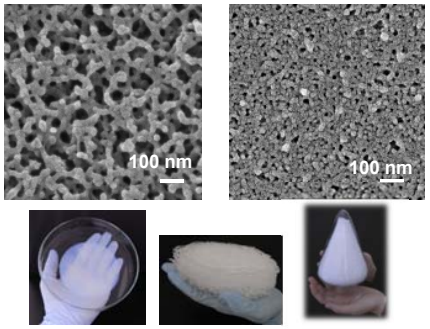
Aim

- Limitation on current fabrication methods for porous polymers using commercial polymers
- Research on phase separation of polymer solutions proposing a new mechanism
- Mesoporous structures made of engineering plastics obtained as monolith, sheet, ...

Advanced Research Topics

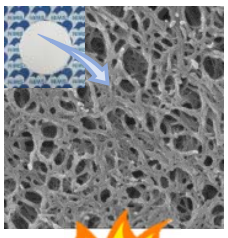
Flash-freezing Nanocrystallization

Template-free fabrication process
Applicable to commercial polymers
(PS, PVC, PSF, PEI, PC, PAN, PVDF,nylon)
Processable into film, sheet, fiber, ...
Uniform pore size ranging from 5–100 nm
High specific surface area S_{BET}>300 m^2/g
Large porosity (> 50%)
Hierarchical meso-macroporous structure



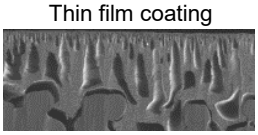
New crystallization on amorphous polymers

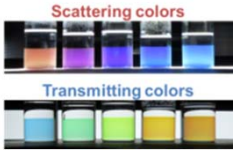
Mesoporous polyethersulfone
Simple fabrication by temperature control of polymer solutions
Thermally-stable solvent-resistant porous polymers
Stability at 150 °C over 600 hours



Applications
Nanofiltration membranes
Oil absorbents
Thermal insulators
Optical materials

Thin film coating





Publications

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Applied area and future prospects

- Possible solutions for environmental and global warming problems
- Porous materials suitable for energy-friendly comfortable life
- Biodegradable porous polymers

Issues for technology transfer

- System design on industrial processing
- Validation and cost evaluation by benchtop equipment
- Performance evaluation and optimization for each application