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Preparation of PES microfiltration membranes with thermo-responsive PNIPAM hydrogel nanocapsules

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Poly(N-isopropylacrylamide) (PNIPAm) is a well-known thermo-responsive polymer which exhibits volume phase-transition at the LCST of PNIPAm and shrinks above the LCST.[1] These hydrogels show a sharp volume transition and response to temperature change. Nano-sized particles of temperature sensitive hydrogels are expected to exhibit very sharp transition or response to the changes in environmental conditions.Membrane technology has been found to be an attractive approach for separation, because the processability and energy efficiency are good.[2] The important goal in membrane technology is to control membrane nano-structure, which affects the membrane performance. Thus extensive research has been conducted in attempting to improve the performance of membrane.

To modify the surface of the 500 nm silica powder, hydrolyzed 3-methacyloxypropyltrimethoxysilane (MPS) was added to the silicon dioxide in ethanol by condensation reaction. Potassium persulfate (KPS) and sodium p-styrenesulfonate (NaSS) were added in the modified silica solutionas initiator and ionic co-monomer, respectively. NIPAm monomer was added and reaction was carried out. We prepared the silica core composite particles with PNIPAm hydrogel shell by using the method of electrostatic repulsion between particles. The core-shell composite particles were soaked in HF solution to remove silica core. PNIPAm hydrogel nanocapsules were applied to PES microfiltration membranes. PES microfiltration membranes were prepared by phase inversion method. To produce the flat sheet membrane, polymer solution made use of polyethersulfone (PES). Polyethylene glycol 600 (PEG600) was added as plasticizer. N-methyl-2-pyrrolidone (NMP) and ethylene glycol monomethyl ether (EGME) was used as solvent and non-solvent, respectively. Also, PES-PNIPAm hydrogel hybrid membranes were made by phase inversion method. PES-PNIPAm hydrogel hybrid membranes were prepared by diffusion. The action of the solvent / non-solvent upon diffusion is remarkably important.

The nanocapsules which were prepared from the composite particles were studied in terms of properties and morphology. Modification and removal of silica core were confirmed by FT-IR spectra. Also, wemeasured the particles size using the dynamic light and observed the particle morphology using TEM and polarizing analysis of optical microscope. Properties of PES-PNIPAm hydrogel hybrid membranes were studied by flux test cell and contact angle analyzer. Also, we measured the morphology of PES-PNIPAm hydrogel hybrid membranes using SEM and polarizing analysis of optical microscope.

The core-shell microparticles were prepared by polymerizing NIPAm on the modified silica particles. Both micron-sized core-shell particles and microcapsule particles could be successfully prepared. PES microfiltration membranes and PES-PNIPAm hydrogel hybrid membranes were prepared by phase inversion method. The application of hydrogel nanocapsules to the hybrid membranes seemsto be a nice precedence study for developing the advanced functional membranes and nanostructure materials.

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UE08

Selective Photoluminescence Dye Patterning by hydrophobic interaction

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the Program for the Training of Graduate Students in Regional Innovation (by MOCIE)

Photoluminescence (PL)and Electroluminescence (EL)materials have been considerably attracted for the potential application in information display areas. These characteristics are determined by light emitting properties when light irradiation or electric current are engaged. Thus, commonly the dyes can be utilized for fluorescent or phosphorescent purposes in EL devices [1]. In this work, the designed dye was considered to the selective dye patterning approaches. Generally, patterning is a necessary skill to modern sciences and technologies such as microelectronics, microelectromechanical systems, biological and chemical sensors, microfluidics, display units, and optoelectronic devices.

In this study, light stamping lithography (LSL) method [2]was used to provide a pattern and red light emitting dye compound having diaminomaleonitrile moiety was synthesised [3]. Light stamping lithography methods include three steps as shown in Fig. 1. This LSL patterning using the red photoluminescence dye was prepared and its corresponding properties were determined (Fig. 2).

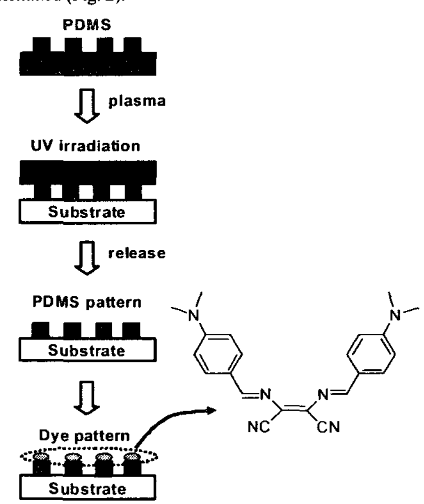

Fig. 1. Schematic outline of LSL patterning.

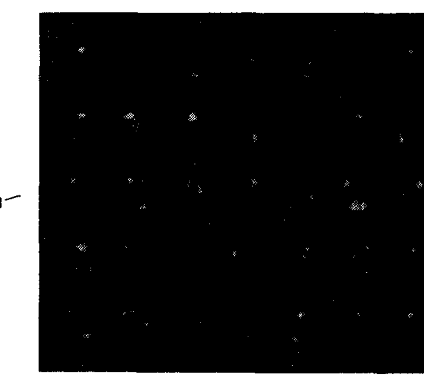

Fig. 2. Fluorescent image of dye material patterning.

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