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Solid-Liquid-Polymer Mixed Matrix Membrane Using Liquid Additive Adsorbed on Activated Carbon Dispersed in Polymeric Membrane for CO2/CH4 Separation

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Abstract : Gas separation by selective transport through polymeric membranes is one of the rapid growing branches of membrane technology. However, the tradeoff between the permeability and selectivity is one of the critical challenges encountered by pure polymer membranes, which in turn limits their large-scale application. To enhance gas separation performances, mixed matrix membranes (MMMs) have been developed. In this study, MMMs were prepared by a solution-coating method and tested for CO₂/CH₄ separation through permeability and selectivity using a membrane testing unit at room temperature and a pressure of 100 psig. The fabricated MMMs were composed of silicone rubber dispersed with the activated carbon individually absorbed with polyethylene glycol (PEG) as a liquid additive. PEG emulsified silicone rubber MMMs showed superior gas separation on cellulose acetate membrane with both high permeability and selectivity compared with silicone rubber membrane and alone support membrane. However, the MMMs performed limited stability resulting from the undesirable PEG leakage. To stabilize the MMMs, PEG was then incorporated into activated carbon by adsorption. It was found that the incorporation of solid and liquid was effective to improve the separation performance of MMMs.

Keywords : mixed matrix membrane, membrane, CO_2/CH_4 separation, activated carbon
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