Influence of Ultem and polyhexafluoropropylene thin films swelling in supercritical carbon dioxide on their gas separation properties

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Widespread use of polymeric membrane materials in many fields of science and technology has stimulated study of new polymer with high permeability and high selectivity as promising materials for gas-transport membrane. Since there is a typical feedback between permeability and selectivity, it is important to develop materials that have both high permeability and selectivity. For this purpose, glassy polymers are used.
Different classes of polymers have been synthesized and studied for use as gas separation membranes. Among them, polyimides are most interesting. They have an unusually high gas selectivity, as well as excellent thermal and mechanical stability and ability to film formation. In addition, there is a wide opportunity to vary the chemical structure of the elementary link for changing the physical properties of polyimides, including their transport characteristics. Previously, we studied the influence of swelling in SC-CO2 on the transport characteristics of a group of polyetherimides of different structures and obtained promising results.
Transport parameters (permeability and selectivity), measured before and after treatment with supercritical carbon dioxide, increased from 16% to 168% and from 5% to 49%, respectively. In this study, we investigated commercial Ultem polymer and compared its behavior to a more flexible polyhexofluoropropylene (PHFP).
We showed that swelling in SC-CO_2 leads to improvement in gas transport properties of polymer membrane. In this case, the difference in behavior of both polymers is related to polymer unit structure, its conformational rigidity and presence of fluorine atoms in the monomer. This leads to microstructure change of polymers in glassy state under influence of SC-CO_2.
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