Improvement of Permeance and Permselectivity of Polyimide Membrane by Carbonization

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A polyimide film was formed on the surface of a porous support tube and was then carbonized at high temperatures. Defects usually caused by gas evolution and shrinkage during the carbonization were completely avoided. The ultimate pore volume determined by CO_2 adsorption increased with increasing carbonization temperature to 0.36 $cm^3 \cdot g^{-1}$, which was 2.2 times larger than that of the initial polyimide. The carbonization increased the gas permeance by two to four orders of magnitude, but the molecular sieving property of the initial polyimide membrane was never lost. This drastic improvement in the permeance was explained mainly by maintaining the initial pore size distribution, not by increasing the micropore volume.

The relationships between permeance and permselectivity was strongly affected by the carbonization temperature and was not correlated by a simple trade-off curve. The optimized carbonization thus realized quite a remarkable increase in the CO_2 permeance to 10^{-7} $mol \cdot m^{-2} \cdot s^{-1} \cdot Pa^{-1}$ and the CO_2/CH_4 permselectivity to 100.

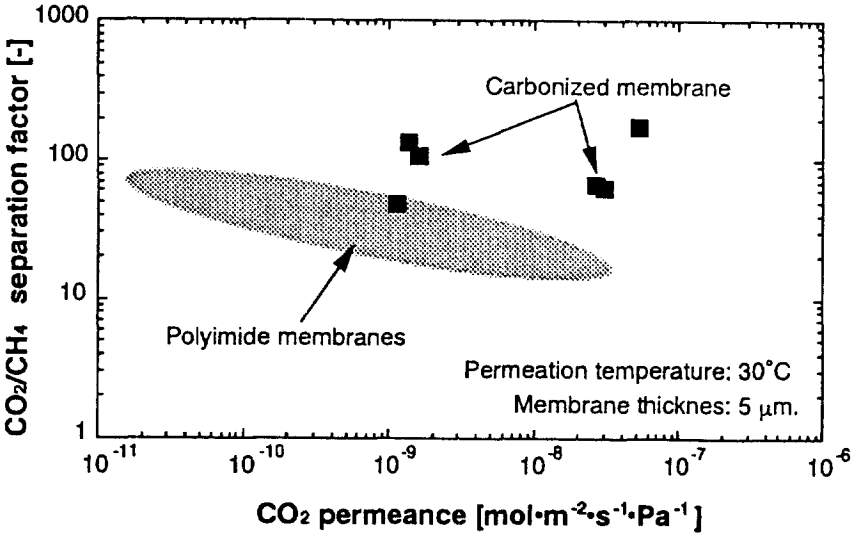

Figure 1. Permeance and permselectivity of carbonized polyimide membranes.

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