407b Synthesis and Gas Permeation Properties of Sodalite Membranes

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Sodalite (SOD) zeolite membranes are highly promising for hydrogen separation from larger gas molecules due to the presence of small ~2.8Å pores formed by the six-membered rings of the SOD cages. Low-silica (Si/Al = 1) SOD membranes were synthesized on alpha-alumina supports by in-situ crystallization from the Na2O-SiO2-Al2O3-H2O solutions employing different aluminum chemical sources and different support positions. The SOD membrane layers exhibited spherical and cubic crystal shapes. XRD, SEM/EDS, and TGA were used to investigate the phase composition, microstructure and thermal behavior of sodalite membranes and powders. In addition, fluorescence confocal optical microscopy (FCOM), a non destructive imaging technique, was employed to collect serial optical images as a function of distance from the top surface of the SOD membranes in order to visualize their detailed microstructure and infer their growth mechanism as a function of time. After dehydration the membranes were characterized by single-gas H2, N2 and CO2 permeation at 323-473K and exhibited the H2/N2 and H2/CO2 permselectivity of ~3 and ~4, respectively. The low H2/N2 and H2/CO2 selectivities observed indicated the presence of macroscopic defects confirmed by SEM and FCOM that were caused by the presence of zeolite impurities and dehydration behavior of these membranes.

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