461e Polymeric Co_2-Selective Membranes Containing Mobile and Fixed Carriers

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CO_2-selective membrane has many applications, including the purification of synthesis gas to obtain high purity hydrogen, the removal of CO_2 from natural gas for natural gas sweetening, and the separation of carbon dioxide from flue gas for the greenhouse gas sequestration. In this study, polymeric CO_2-selective membranes consisting of an amino acid salt as the mobile carrier and polyamine as the fixed carrier in crosslinked poly(vinyl alcohol) were synthesized.

Transport properties of the membranes synthesized including CO_2/H_2 selectivity, CO_2/N_2 selectivity, CO_2 permeability, and CO_2 flux were studied with a gas stream containing hydrogen, carbon dioxide, and nitrogen. The effects of temperature, feed pressure, water concentration, membrane thickness on transport properties were investigated. The membranes showed good CO_2 permeability and CO_2/H_2 selectivity up to 170^{o}C for the feed gas pressure of 2.1 atm and the sweep gas of atmospheric pressure. Yet both CO_2 permeability and CO_2/H_2 selectivity decreased as temperature increased from 110^{o}C to 170^{o}C, which was presumably due to the reduction of water retention in the membrane as the temperature increased. CO_2/H_2 selectivity and CO_2 flux were studied as a function of membrane thickness. Based on the transport data from the membranes of different thickness, the total mass transfer resistance of CO_2 through the membrane was determined as a function of membrane thickness. Thus, the 'true' permeability, which is independent of membrane thickness was determined. In addition, CO_2/CO selectivity was studied with a gas stream containing hydrogen, carbon monoxide, carbon dioxide, and nitrogen, which showed the membranes had high CO_2/CO selectivity over the temperature rang from 110^{o}C to 170^{o}C.