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Graphene oxide – molybdenum disulfide hybrid membranes for hydrogen separation

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Abstract

Graphene oxide – molybdenum disulfide hybrid membranes were prepared using vacuum filtration technique. The thickness and the MoS_2 content in the membranes were varied and their H_2 permeance and H_2/CO_2 selectivity are reported. A 60 nm hybrid membrane containing ~75% by weight of MoS_2 exhibited the highest H_2 permeance of 804×10^{-9} mol/m^2·s·Pa with corresponding H_2/CO_2 selectivity of 26.7; while a 150 nm hybrid membrane with ~29% MoS_2 showed the highest H_2/CO_2 selectivity of 44.2 with corresponding H_2 permeance of 287×10^{-9} mol/m^2·s·Pa. The hybrid membranes exhibited much higher H_2 permeance compared to graphene oxide membranes and higher selectivity compared to MoS_2 membranes, which fully demonstrated the synergistic effect of both nanomaterials. The membranes also displayed excellent operational long-term stability.

Keywords: Graphene oxide; molybdenum disulfide; composite membranes; vacuum filtration; gas separation.