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Graphene oxide – molybdenum disulfide hybrid membranes for hydrogen separation

Mayur Ostwal, Digambar B. Shinde, Xinbo Wang, Ikhlas Gadwal and Zhiping Lai*

Advanced Membranes and Porous Materials Center, Division of Physical Science and Engineering, King Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Kingdom of Saudi Arabia

*Corresponding Author: zhiping.lai@kaust.edu.sa

Abstract

Graphene oxide – molybdenum disulfide hybrid membranes were prepared using vacuum filtration technique. The thickness and the MoS₂ content in the membranes were varied and their H₂ permeance and H₂/CO₂ selectivity are reported. A 60 nm hybrid membrane containing ~75% by weight of MoS₂ exhibited the highest H₂ permeance of 804×10^{-9} mol/m²·s·Pa with corresponding H₂/CO₂ selectivity of 26.7; while a 150 nm hybrid membrane with ~29% MoS₂ showed the highest H₂/CO₂ selectivity of 44.2 with corresponding H₂ permeance of 287×10^{-9} mol/m²·s·Pa. The hybrid membranes exhibited much higher H₂ permeance compared to graphene oxide membranes and higher selectivity compared to MoS₂ 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.

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