Frontiers of
Chemical Science and Engineering

Vol. 15 No. 4 August 2021

Cover story

(Wei Wang, Yanying Wei, Jiang Fan, Jiahao Cai, Zong Lu, Li Ding, Haihui Wang, pp. 793–819)
Membrane-based separation technologies have received increasing attention attributing to lots of advantages such as the low energy consumption, easy operation, and environmental friendliness. Two-dimensional (2D) materials have emerged as a class of promising materials to prepare high-performance 2D membranes for various separation applications. The precise control of the interlayer nano-channel/sub-nanochannel between nanosheets or the pore size of nanosheets within 2D membranes enables 2D membranes to achieve promising molecular sieving performance. To date, many 2D membranes with high permeability and high selectivity have been reported, exhibiting high separation performance. This review presents the development, progress, and recent break-through of different types of 2D membranes, including membranes based on porous and non-porous 2D nanosheets for various separations. Separation mechanism of 2D membranes and their fabrication methods are also reviewed. Last but not the least, challenges and future directions of 2D membranes for wide utilization are discussed in brief.

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Available online
http://www.springerlink.com

CN 11-5981/TQ
邮发代号: 80-969

ISSN 2095-0179

11705

FRONTIERS OF CHEMICAL SCIENCE AND ENGINEERING Volume 15 ▪ Number 4 ▪ 2021 ▪ pp 717–1032

Engineering
Transactions of CAE

ISSN 2095-0179
Volume 15 ▪ Number 4
August 2021