Tuning Nanochannel of Graphene Oxide Membrane via Crown Ether Intercalation for Desalination

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2D materials such as graphene and MXene provide an emerging platform for separation membranes. With their atom-scale thickness, unique nanopores and nanochannels can be exploited, leading to a high-performance in different kinds of separation. Such 2D materials including graphene oxide (GO) can produce a stacked-structure, while it enables us to control the size of nanochannel via molecular intercalation. It can be particularly advantageous for seawater desalination since it requires an efficient removal of salt molecules such as NaCl, simultaneously achieving high water permeation. In this study, we prepared a laminate of GO nanosheets intercalated by crown ethers through CH-π interaction, and the ion permeation and water flux through the membrane were investigated. It was expected that the intercalated crown ethers tune the ion sieving within GO membrane due to their unique cation-binding characteristics. The hybrid-layered membrane exhibits an improved salt rejection and high water flux performance compared with a pristine GO membrane. Moreover, our results show that the hybrid-layered GO membrane maintains its robustness under various salt solutions for a long period of time.