Highly Swelling Resistant Reduced Graphene Oxide Membrane with Tuning Nanochannel by Intercalating Crown Ether

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Membrane separation using graphene derivatives is an emerging technology for gas separation and desalination. While graphene oxide (GO) is mostly utilized as a membrane material, the GO-based membrane is swelling in aqueous solution due to the hydrogen bonding between oxygen functional groups and water molecules. To overcome such structural vulnerability and enhance the desalination performance, we prepared reduced GO based membrane (rGOM) with the intercalation of crown ethers. Since the channel size of rGO becomes narrow in comparison with GO, it is difficult to distribute crown ether molecules between layers through vacuum filtration. Therefore, we maneuvered the rGOM via a hydrazine vapor reduction to prevent any possible structural destruction. Our results show that the swelling of the rGOM was effectively inhibited due to the reduction of oxygen functional groups, simultaneously ion transport being disturbed by the molecular intercalation. It is attributed to the tight interaction between the crown ether and the rGO layers, successfully maintaining the tuned channel size over the membrane and keeping the membrane from swelling.