Thermally Activated Nanoporous Graphene with Oxidation for Ultrafast Nanofiltration Membrane

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In this study, we developed a functionalized nanoporous graphene (FNG) membrane to alleviate the typical issues of graphene-based membranes, such as the low water flux and poor stability in aqueous solvents. Nanoporous graphene (NG) was prepared by thermally annealing graphene oxide (GO) at 650 ℃, leading a turbostratic and amorphous structure with nanopores below 4 nm. Following, the NG was partially oxidized by $KMnO_4$ treatment to disperse nanoporous graphene in water. The membrane exhibited high water permeance of 586 $Lm^{-2}h^{-1}bar^{-1}$ and low molecular weight cut off (MWCO) of 269 Da, surpassing the upper bound of reported polymers and 2D materials-based nanofiltration membranes. In addition, the FNG membrane is highly stable under the cross-flow filtration, and the decline of water flux is suppressed by the abundant nanopores on the basal plane of graphene compared to normal GO membranes during the practical long-term filtration.