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Effect of Microstructure of Graphene Oxide Fabricated through Different Self-Assembly Techniques on Alcohol Dehydration

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Abstract : We utilized pressure, vacuum, and evaporation-assisted self-assembly techniques through which graphene oxide (GO) was deposited on modified polyacrylonitrile (mPAN). The fabricated composite GO/mPAN membranes were applied to dehydrate 1-butanol mixtures by pervaporation. Varying driving forces in the self-assembly techniques induced different GO assembly layer microstructures. XRD results indicated that the GO layer d-spacing varied from 8.3 Å to 11.5 Å. The self-assembly technique with evaporation resulted in a heterogeneous GO layer with loop structures; this layer was shown to be hydrophobic, in contrast to the hydrophilic layer formed from the other two techniques. From the pressure-assisted technique, the composite membrane exhibited exceptional pervaporation performance at 30 C: concentration of water at the permeate side = 99.6 wt% and permeation flux = 2.54 kg m-2 h-1. Moreover, the membrane sustained its operating stability at a high temperature of 70 C: a high water concentration of 99.5 wt% was maintained, and a permeation flux as high as 4.34 kg m-2 h-1 was attained. This excellent separation performance stemmed from the dense, highly ordered laminate structure of GO.

Keywords : graphene oxide, self-assembly, alcohol dehydration, polyacrylonitrile (mPAN)
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