

Design of Asymmetric Nanochannel in Epoxy-Wrapped Graphene Oxide Membrane for High-Performance Osmotic Power Generation

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Osmotic power obtained from the salinity gradient between seawater and river water is regarded as a promising future energy. The performance of reverse electrodialysis (RED), one of membrane-based approaches to harvest osmotic energy, largely depends on selective ion transport via the membrane, so that graphene oxide (GO) membranes have been widely studied due to superior ion selectivity derived from controllable nanochannels. However, as the GO channel structure is vulnerable to swelling in an aqueous environment, it is difficult to maintain the power generation performance and energy conversion efficiency in a sustainable way. Here, we developed an anti-swelling epoxy-wrapped GO membrane with asymmetric channels to enhance the RED performance. The asymmetric channel in the membrane was formulated along the horizontal direction using molecular vapor diffusion, and ionic current rectification originated from such structure can reduce energy loss during diffusion. Our results show that the asymmetric epoxy-wrapped membrane can improve energy conversion efficiency as well as maintain power density performance for a long operating time.