

# Electrochemical Synthesis and Membrane Applications of Graphene Oxide

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Graphene oxide (GO) has shown a great potential for various applications such as separation membranes, catalysis, energy storage, biomedicine, and composites. However, the present synthesis methods depend on the reactions of graphite with mixed strong oxidants, which suffer from explosion risk, serious environmental pollution, and long reaction time up to hundreds of hours. For separation membrane applications, it is challenging to further improve the water permeability without sacrificing the separation efficiency, and the GO membranes are easily delaminated in aqueous solutions even within few hours.

Here, we report a scalable, safe, ultrafast and green method to synthesize GO with a high yield based on water electrolytic oxidation of graphite [1]. The graphite lattice is fully oxidized within a few seconds in our electrochemical oxidation reaction, and the GO obtained is similar to those achieved by the present methods. We also discuss the synthesis mechanism and demonstrate continuous and controlled synthesis of GO.

In addition, we develop a unique class of reduced GO membranes with enlarged interlayer distance [2]. They show water permeance 10 – 1,000 times higher than those of the reported GO-based membranes and commercial membranes, and good separation efficiency. Moreover, they also show no damage or delamination in water, acid and basic solutions even after months.

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References

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- [2] K.H. Thebo, X.T. Qian, Q. Zhang, L. Chen, H.M. Cheng, W.C. Ren, *Nature Communications*, Accepted.