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# Scalable production of defect-free graphene sheets using rotor–stator mixer in supercritical $CO_2$ and their applications

Abstract

A green and scalable approach was presented for the production of defect-free graphene sheets by the exfoliation of graphite using a rota-stator mixer in supercritical CO2. The synergistic effects of the fluid dynamic force coupled with the supercritical CO2 were investigated by the combination of experiments and CFD simulation. The characterization results by transmission electron microscopy, Raman spectroscopy and atomic force microscopy confirmed that the total exfoliation yield reached more than 70%. Up to 80% of the produced graphene was less than five layers. The CFD simulation showed that the geometry of the mixer and the velocity gradient influenced greatly the exfoliation efficiency. The graphene-based flexible films with high electrical conductivity were fabricated by inkjet printing the ink which was formulated using the as-prepared graphene, ethyl cellulose and cyclohexanone. Also, the polyaniline/graphene/MnO2 composite paper electrode with the area capacitance of 3.5 F/cm2 and excellent stability was constructed. Accordingly, the all-solid-state supercapacitors were assembled and could lighten a green LED light.

## References

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## Figures

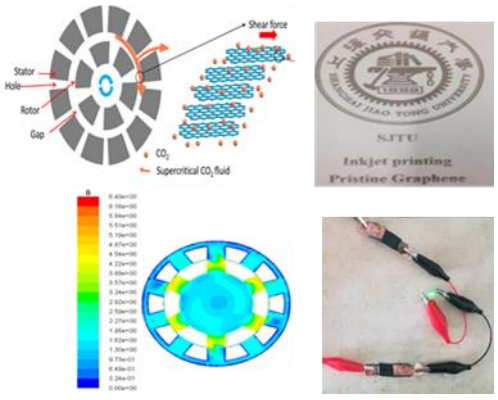


**Figure 1: Rotor and stator mixer, fluid flow pattern, printing conductive pattern and supercapacitor**