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FREE-STANDING THIN FILM USING REDUCED GRAPHENE OXIDE WITH LOW SHEET RESISTANCE

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ABSTRACT

In recent years, graphene-based free-standing films have attached much attention in *wearable electronic devices* due to their excellent conductivity and mechanical strength. However, the current synthesis and fabricating process cannot achieve mass production because of its high cost and sophisticated synthesis methods, which includes chemical vapor deposition (CVD), mechanical exfoliation, and epitaxial growth. In contrast, the reduction of graphene oxide (GO) stable aqueous solution is an effective way to produce large-scale production. In this paper, a free-standing reduced graphene oxide (RGO) paper with low sheet resistance was fabricated by a novel simple drop-casting method. Suitable reducing agents and proper fabrication methods are needed to produce high quality RGO free-standing films. The synthesized RGO solution was using green reductant L-ascorbic acid (L-AA) at a low temperature. L-AA is an effective and mild reductant that can reduce most hydroxy and epoxy groups attached to the GO. The RGO free-standing film was fabricated by drop-casting the solution on the Anodisc membrane filter and peeling it off after the reduction process. The adhesion force between the film and the membrane can eliminate the formed hydrophobicity of the film in the reduction process. As a result, RGO films with the Anodisc membrane remain the same shape. Furthermore, the lateral morphology was characterized by scanning electron microscopy (SEM) to measure the thickness and the sp^2-hybridization structure and defects were investigated by Raman structure. The results show that the RGO samples had few structural defects and it achieves low sheet resistance at around 300 Ω/sq. Residual functional groups attached to the RGO and structural defects can break the conjugated structure of RGO and localized π-electrons. The produced RGO free-standing film with good flexibility and conductivity can be potentially applied in flexible optoelectronic devices.