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Full Title - Highly Conductive Free-Standing Reduced Graphene Oxide Thin Films for Fast Photoelectric Devices

Compared to mechanically exfoliated and chemical vapor deposited graphene, reduced graphene oxide (RGO) has unique advantages such as wet process, high yield and capability of assembling large-area thin films on varied substrates. However, RGO is normally not recommendable for advanced devices due to its poor electrical conductivity. Here we report a new method to prepare highly conductive free-standing RGO thin film. The as-prepared RGO thin film possesses the highest conductivity of 87100 S m^{-1}, the second-lowest sheet resistance of 21.2 Ω sq^{-1} and the medium level mobility of 16.7 $cm^2 \cdot V^{-1} \cdot s^{-1}$ among all the RGO films reported so far. To demonstrate the application potential of the free-standing RGO thin films in photoelectric devices, a fully suspended RGO photodetector is constructed using the free-standing RGO thin film, which exhibits the fastest (*ca.*100 ms) and broadest (from ultraviolet 375 nm to terahertz 118.8 μm spectral range) photoresponse among all RGO film photodetectors to date. The response speed is even comparable to those of CVD grown-graphene photodetectors and mechanically exfoliated graphene photodetectors. This work would pave the way to high-conductivity RGO thin films by wet process assembly, thus facilitating applications of RGO in advanced electronic, optoelectronic and sensing devices.

References

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Figures

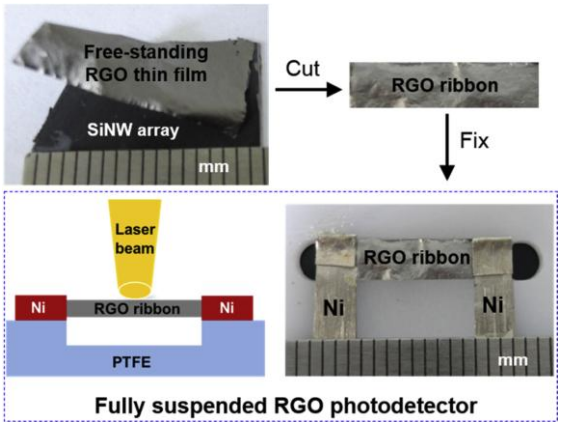

Figure 1: Digital photograph and schematic diagram of the fully suspended RGO thin film photodetector for photoresponse measurement. The incident laser spot was positioned in the middle of the free-standing RGO thin film.