

# Electrochemically Exfoliated Graphene as Solution Processable, Highly-Conductive Electrodes for Organic Electronics

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## Abstract

Solution processable thin layer graphene is an intriguing nanomaterial with tremendous potential for electronic applications. In this work, we demonstrate that electrochemical exfoliation of graphite furnishes graphene sheets in high quality and high yield. The electrochemically exfoliated graphene (EG) has a large sheet size ( $\sim 10 \mu\text{m}$ ), high C/O ratio of 12.3 and low sheet resistance ( $4.8 \text{ k}\Omega/\square$ ) which comparable to that of CVD graphene. Due to the solution-processability ( $\sim 1 \text{ mg/mL}$  in DMF) of such graphene sheets, large and homogeneous graphene films can be fabricated on both rigid and flexible substrates by vacuum filtration and subsequent transfer to the desired substrates. The resulting graphene films exhibit sheet resistances of  $4.1$  and  $2.4 \text{ k}\Omega/\square$  with transmittances of  $85\%$  and  $73\%$ , respectively. Patterned graphene films can serve as high-performance source/drain (S/D) electrodes for OFETs. an serve as high-performance source/drain (S/D) electrodes for OFETs.

## References

- [1] X.Wang, L. Zhi, K. Müllen, Nano Lett. **8** (2008) 323-327.
- [2] P. Matyba, H. Yamaguchi, G. Eda, M. Chhowalla, L. Edman, N.D. Robinson, ACS Nano **4** (2010) 637-642.
- [3] S. Pang, H.N. Tsao, X. Feng, K. Müllen, Adv. Mater. **21** (2009) 1-4.
- [4] A. Reina, X.T. Jia, J. Ho, D. Nezich, H.B. Son, V. Bulovic, Nano Lett. **9** (2009) 30-35.

## Figures

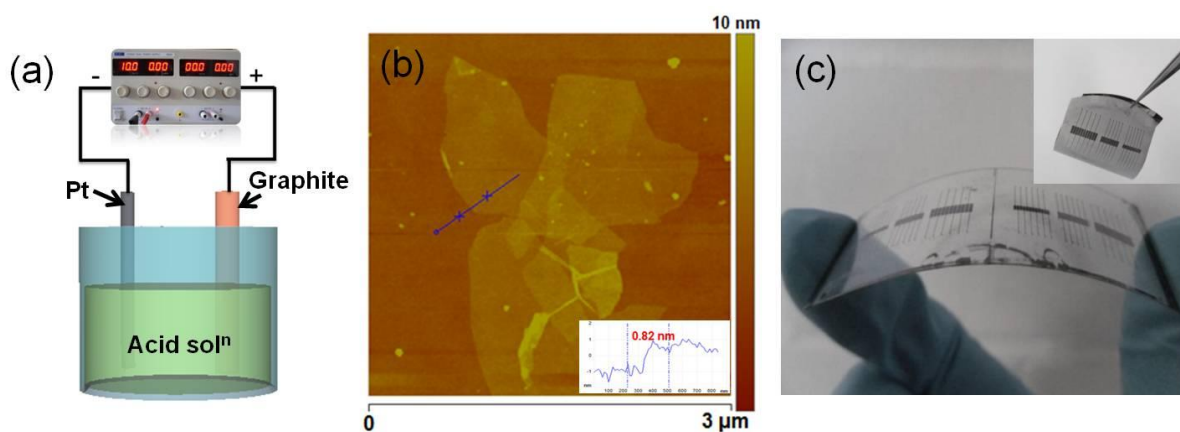


Figure caption: (a) Schematic illustration of the electrochemical exfoliation of graphite, (b) AFM image of the exfoliated graphene sheet and, (c) photograph of the patterned graphene electrodes on PET substrate and filter paper (inset).