Robust, High-Performance of Flexible, Transparent Conducting Films from Graphene and their Shape Memory Polymer Nanocomposites

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The graphene discovered in 2004 from Dr. Geim et al., it has been touted as a "next generation materials" because of its remarkable optical, electronic, and thermal properties, chemical and mechanical stability, and large surface area for applications in emerging field such as transistors, sensors, polymer nanocompoistes, energy devices.

In general, shape memory polymers are very usefully materials in bio and medical research area. Specially, polyurethane block copolymers are able to recover the original shape almost completely at appropriate conditions when they are deformed. These materials have the advantages of light weight, and excellent processability. For this reason, polyurethane block copolymer may play an important role in thin area. Consequently, the combination of shape memory polyurethane with graphenes allows to creating new polymeric materials with unique high performance properties.

In this study, we have used highly quality graphenes, prepared by the solvent exfoliation process from expended graphite (EG). To understand the effects of the exfoliation quality of graphenes and dispersion property of graphenes within the PU, graphene solution in NMP were prepared under strong sonication and centrifuge. Finally, graphene/PU composite films were evaluated in terms of their optical, mechanical and thermal properties as well as electrical conductivity.

References

[1] X. K. Lu, M. F. Yu, H. Huang, R. S. Ruoff, Nanotechnology **10** (1999) 269
[2] K. S. Novoselov, A. K. Geim, S. V. Morozov, D. Jiang, Y. Zhang, S. V. Dubonos, I. V. Grigorieva, A. A. Firsov, Science **306** (2004) 666.
[3] J. C. Meyer, A. K. Geim, M. I. Katsnelson, K.S. Novoselov, T. J. Booth, S. Roth, Nature **446** (2007) 60.
[4] K. I. Bolotin, K.J. Sikes, Z. Jiang, M. Klima, G. Fudenberg, J. Hone, P. Kim, H. L. Stormer, Solid State Commun. **146** (2008) 351.
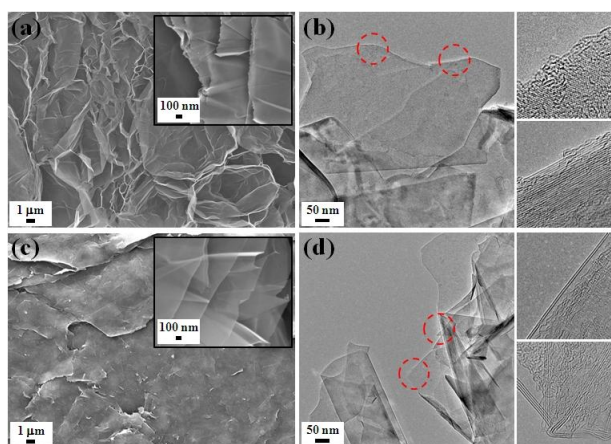
Figure 1. SEM and TEM images of pristine expanded graphite (a,b), and exfoliated graphene (c,d)

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