GrapHEL

A European Conference/Workshop on the Synthesis, Characterization and Applications of Graphene

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Electronic Book of ABSTRACTS

Plenary Talks

1. Graphene, carbon nanotubes and spintronics
A. Fert, A. Anane, C. Berger, W. de Heer, C. Deranlot, B. Dlubak,L. Hueso, H. Jaffres, M-B. Martin, N. Mathur, F. Petroff,P. Seneor, M. Sprinkle, B. Servet, S. Xavier, H. Yang

2. Raman Spectroscopy and Photonics of Graphene
A. C. Ferrari

3. Graphene: Chemistry, Liquid Crystals and Macroscopic Assembly
C. Gao

4. Nanomechanics of The Fantastic 4: graphene (the strongest), spider silk (the toughest), gecko foot (the most adhesive) and lotus leaf (the most anti-adhesive)
N. M. Pugno

5. Graphene-based and Graphene-derived Materials
R. Ruoff

6. Graphene bionanoscience & engineering: Toward DNA sequencing with graphene
G. F. Schneider

Session A: Synthesis & Production Processes

E70 - Morphology Control of Graphene Oxide in Polymer Matrix, and its Composites

C. Sellam, C. Wang, E. Bilotti, H. Deng, A. Barber, Ton Peijs

E73 - Optimizing the Reinforcement of Polymer-Based Nanocompositesby Graphene

R. J. Young, L. Gong, I. A. Kinloch, I. Riaz, R. Jalil, K. S. Novoselov

E74 - The Graphene Radio

M. Dragoman,D. Neculoiu, A. Cismaru, G. Deligeorgis ,G. Konstantinidis, D. Dragoman

E86 - Study of thermal transport properties of CVD grown graphene membranes: a route to graphene-based thermal sensing device

G.P. Veronese, C. Degli Esposti-Boschi, M. Ferri, P. Maccagnani, L. Ortolani, R. Rizzoli, A. Roncaglia, V. Morandi

E98 - Elastomer/nanographite composites for mechanical and chemical sensing

M. Knite, L. Matzui, J. Zavickis, G. Sakale, A. Linarts, K. Ozols, I. Aulika

E99 - Highly Efficient Low Temperature Chemical Reduction Of Graphene Oxide Thin Films for Transparent Electrodes

A. de Andrés, X. Díez-Betriu, S. Álvarez-García, J. Sánchez-Marcos, R. Jiménez-Riobóo, C. Prieto, C.Botas, P. Alvarez, R. Menéndez, H. Varela-Rizo

E100 - Field-Effect Tunneling Transistor Based on Vertical Graphene Heterostructures

T. Georgiou, L. Britnell, R. V. Gorbachev, R. Jalil, B. D. Belle, F. Schedin, A. Mishchenko, M. I. Katsnelson, L. Eaves, S. V. Morozov, N. M. R. Peres, J. Leist, A. K. Geim, K. S. Novoselov, L. A. Ponomarenko

E112 - Highly-Tunable CNT and Graphene Polymer Nanostrures: A Rapid and Facile Approach for Controlled Architecture and Composition

G.Mechrez, R. Y. Suckeveriene, E.Segal, M. Narkis

Posters

P1 - Synthesis and applications of graphene grown directly on insulators

N. Lindvall, J. Sun, A. Yurgens

P2 - Few-Layered Graphene Obtained From Graphite and Graphite

Elastomer/nanographite composites for mechanical and chemical sensing

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Based on our results in elaboration and investigation of polyisoprene/high structured carbon black composites we can achieve excellent piezoresistivity effect [1] as well as chemoresistivity effect [2] for these composites. In this study we attempt to design polyisoprene matrix composites with promising more sophisticated fillers – thermoexfoliated graphite (TEG) as well as multiwall carbon nanotubes with high (LMWCNT) and low (SMWCNT) aspect ratio for their application in design of new sensitive polymer composites. TEG has been synthesized in Department of Physics of Kyiv National Taras Shevchenko University. Powders of LMWCNT and SMWCNT have been bought from Cheap Tubes Inc. Polyisoprene/TEG and polyisoprene /MWCNT composites were prepared in Institute of Technical Physics of Riga Technical University. Firstly each filler party was dispersed in chloroform in one vessel by ultrasonic homogenizer. Secondly polyisoprene and necessary additives, zinc oxide and sulphur were dissolved in chloroform in another vessel by magnetic stirring. After the definite filler dispersion was added to polyisoprene solution and the mixture was mixed by magnetic stirring for 24 hours. From the obtained raw mixture chloroform was evaporated. Finally the mixture was vulcanized under pressure of 30 atm at 150^{o}C for 15 minutes. The acquired nanocomposite samples were electrically conductive and showed the ability to change the electrical resistance under the influence of mechanical force and volatile compound vapours as well. The electrical conductivity appeared due to forming of 3D grid of nanosize channels in polymer matrix of composite during vulcanization.

Mechanical sensing principle works as follows. Under influence of mechanical force the conductive 3D grid is being disarranged and electrical resistance raises. The fact of presence of nanosize conductive structures guarantees the good reversibility of resistance change.

The chemical sensing of composites can be explained in the following way. The composites absorb chemical vapours and, because of matrix swelling, partially disarrange 3D conductive grid and, thus, increase electrical resistance. Such elastomer chemiresistors could be attractive and energy efficient sensor materials for long-term air quality monitoring. This is different from semiconductor sensing elements. Elastomer chemiresistors do not need external heating to maintain the sensing capability to organic solvent vapours.

Preliminary piezoresistivity and chemoresitivity DC tests as well as AC tests of all elastomer/nanographite composites eleborated show promising results. Polyisoprene/TEG composite has higher sensitivity to chemicals then polyisoprene/LMWCNT. Based on these results we expect better sensor effect of polymer/single graphene composites in future attempts.

References

1. **Zavickis, J., Knite, M., Podins, G., Linarts, A., Orlovs R**., Polyisoprene – nanostructured carbon composite – a soft alternative for pressure sensor application, *Sensors and Actuators. A: Physical,* **171** (2011), 38-42
2. **Sakale, G., Knite, M., Teteris, V**.,Polyisoprene-nanostructured carbon composite (PNCC) organic solvent vapour sensitivity and repeatability, *Sensors and Actuators. A: Physical,* **171** (2011), 19-25.