Page 116: The abstract of Edson Nossol *et al.*, presented as Contributed talk C17 by Aldo J.G. Zarbin was duplicated from the talk he presented at the CNTFA13 Satellite Symposium. The correct NT13 abstract for talk **C17** is:

Liquid-liquid interfaces: a suitable environment to prepare carbon nanostructures-based thin films

Rodrigo V. Salvatierra[1], Sergio H. Domingues[1], Hiany Mehl[1], Vitor Hugo R. Souza[1] Carlos E. Cava[1,2], Lucimara S. Roman[2], Marcela M. Oliveira[3], Aldo J.G. Zarbin[1]

1 Department of Chemistry, Federal University of Parana (UFPR), Brazil (aldozarbin@ufpr.br)
2 Department of Chemistry, Federal University of Parana (UFPR), Brazil
3 Department of Chemistry & Biology, Technological Federal University of Parana (UTFPR), Brazil

We have recently described a very versatile and efficient method to obtain homogeneous and transparent thin films of graphene- and carbon nanotubes-based polymer nanocomposites, through a chemical reaction at an aqueous-organic interface. In this work we show that this is a general method that can be extended to other kind of nanocomposites, as well as to prepare films based on one-phase composition material. The materials are directly obtained at the immiscible liquid/liquid interface as a free standing, transparent and self-assembled films. The films can be easily removed from interface and deposited over any kind of substrate, which represent a good advance in order to build efficient and reproducible devices. Thin, transparent, homogeneous and conducting films of CNTs, graphene, grahene/silver nanoparticles, CNTs/polyaniline, graphene/polianiline, CNTs/polythiophene and graphene/thiophene, deposited over ordinary and flexible substrates, will be presented. Application as ITO substitutes for transparent electrodes, in photovoltaic devices, sensors, electrochromic materials and as SERS substrates will be presented and discussed in light of the structure and morphology of the nanostructured films.

[1] R.V. Salvatierra, M.M. Oliveira, A.J.G. Zarbin, Chem. Mater. 22 (2010) 5222
[2] S.H.Domingues, R.V.Salvatierra, M.M. Oliveira, A.J.G. Zarbin, Chem. Comm. (2011) 2592
[3] R.V. Salvatierra, C.E. Cava, L.S. Roman, A.J.G. Zarbin, Adv. Funct. Mater. 23 (2013) 1490
[4] R.V. Salvatierra, S.H. Domingues, M.M. Oliveira, A.J.G. Zarbin, Carbon 57 (2013) 410
[5] C.E. Cava, R.V. Salvatierra, D.C.B. Alves, A.S. Ferlauto, A.J.G. Zarbin, L.S. Roman, Carbon 50 (2012) 1953

Page 120: The abstract of Gugang Chen *et al.* was replaced by the abstract of Jian-Cheng Chen. The correct NT13 abstract for poster **P137** is:

In situ refreshing enabled parts-per-quadrillion gas detection with pristine carbon nanotubes and graphene

Gugang Chen and Avetik R. Harutyunyan*

*Honda Research Institute USA Inc., 1381 Kinnear Road, Columbus, OH 43212, USA (*aharutyunyan@honda-ri.com)*

Single-walled carbon nanotube (SWNT) and graphene are very promising for ultrasensitive gas detection since they consist solely of surface so that every atom is in direct contact with nearby analyte molecules. However, it is very challenging to achieve super-sensitivity due to virtually unavoidable interfering species present in the detection environment. This may partially explain why we are still far from what a pristine SWNT or graphene can offer even after more than a decade of research. Here we illustrate a novel route to address this issue. Through in situ refreshing of the sensor surface with continuous ultraviolet light illumination during the course of detection, we have observed 2 to 4 orders of magnitude better sensitivity than current state-of-the-art results for a range of gas molecules, and for the first time entered parts-per-quadrillion (PPQ) detection level at room temperature [1, 2]. The study further points out how to exploit the intrinsic sensitivities of other nanomaterials.

[1] G. Chen, T. M. Paronyan, E. M. Pigos, and A. R. Harutyunyan, Scientific Reports 2, 343 (2012)
[2] G. Chen, T. M. Paronyan, and A. R. Harutyunyan, Appl. Phys. Lett. 101, 053119 (2012)

Page 122: The abstract of Zhuangjun Fan *et al.* was by mistake replaced by the abstract of Zeng Fan *et al*. The correct NT13 abstract for poster **P142** is:

A three-dimensional carbon nanotube/graphene sandwich and its application in supercapacitors

Zhuangjun Fan[1], Jun Yan[1], Tong Wei[1], Fei Wei[2]

1 Key Laboratory of Superlight Materials and Surface Technology, Ministry of Education, College of Material Science and Chemical Engineering, Harbin Engineering University, Harbin 150001, P. R. China (fanzhj666@163.com)
2 Beijing Key Laboratory of Green Chemical Reaction Engineering, and Technology, Department of Chemical Engineering, Tsinghua University, Beijing 100084, P. R. China

Owing to its unique electrical, thermal, and mechanical properties, graphene has attracted great attention in various application areas, such as energy-storage materials, free-standing paper-like materials, polymer composites, liquid crystal devices and mechanical resonators. Among various approaches, the oxidation and reduction of graphite is one of the most effective methods in mass production of grapheme for industrial applications. However, the reduction of grapheme oxide (GO) results in always a gradual decrease of its hydrophilic character, which leads to irreversible agglomeration and precipitation, though GO itself is highly hydrophilic and can form stable dispersion in aqueous solvents. As a result, the unique 2D feature of graphene would be lost.

In this paper, for the first time, we report a novel strategy to prepare 3D CNT/grapheme sandwich (CGS) structures with CNT pillars grown in between the graphene layers by CVD approach. The CGS has been used successfully as electrodes in supercapacitors, and a maximum specific capacitance of 385 F g−1 has been obtained at a scan rate of 10 mV s−1 in 6 M KOH aqueous solution. After 2000 cycles, a capacitance increase of ca. 20% of the initial capacitance is observed, indicating excellent electrochemical stability of the electrode. This new carbon material is also expected to be useful as electrode material in Li-ion secondary batteries, as media for hydrogen storage, as catalysts for fuel cells, and as component for other clean energy devices.

Page 129: The abstract of I.A. Komarov et al. was duplicated from an NCC13 Satellite symposium abstract he is coauthoring. The correct NT13 abstract for poster **P157** is:

Nanotube based biosensor for accurate thrombin detection on flexible substrate

I.A. Komarov[1,*], I.I. Bobrinetsky[1], A.V. Golovin[2], A.O. Zalevsky[2,*]

1 National Research University of Electronic technology, Russian Federation (bobrinet@mail.ru)
2 Moscow State University, Russian Federation (aozalevsky@gmail.ru)

Biological sensors is a promising area of nanomaterials applications. Single wall carbon nanotubes (SWCNT) have high specific surface area as well as high sensivity to environment which make them applicable as interface between biological targets and electronic devices [1]. In that case a signal from small biological objects could be taken in easy-to-use form.

In the present work we describe assembly of high-sensitive biosensor at flexible substrate sensitive to human thrombin - key protein of blood coagulation cascade. We showed consistency of sensor response results with those obtained by molecular dynamics simulations and quantum mechanics calculations. SWCNT were modified with thrombin binding aptamer to form a sensitive layer on a flexible substrate. Formation of aptamer-protein complex changes aptamer conformation which affects charge distribution on nanotube's surface and results in changes of sensor resistance. As we showed the resistance of the structure decreased in ~45%. Reaction time is about 100 seconds. We used albumin protein as a control sample. The resistance decreased in 16% that is much less than response on thrombin.

Combination of experimental and computational methods gives deep understanding of underlying mechanisms which is crucial for successful development of highly specific highly sensitive sensors based on unique features of aptamers and single wall carbon nanotubes. These is the first time the carbon nanotube-based aptasensor was made on flexible substrate.

[1] Chengguo Hu, Shengshui Hu. Journal of Sensors, Volume 2009, Article ID 187615, 40 pages, doi:10.1155/2009/187615

Page 151: An incorrect version of the abstract of Huiliang Wang et al. was printed in the book. The correct abstract for poster **P200** is:

Simple and scalable dispersion of semiconducting arc-discharged carbon nanotubes by dithiafulvalene/thiophene copolymers for thin film transistors

Huiliang Wang[1], Jianguo Mei[2], Zhenan Bao[2]

1 Department of Materials Science and Engineering, Stanford University, US (whl0903@stanford.edu)
2 Department of Chemical Engineering, Stanford University, US

Semiconducting single-walled carbon nanotubes (SWNTs), with high charge carrier mobility and solution processibility, hold a great promise for high-performance low-cost thin film transistor applications. However, separating semiconducting SWNTs from metallic ones in large quantities still remains a challenge. It has been reported that conjugated polymers such as polyfluorene or polythiophene can sort small diameter semiconducting SWNTs. Large-diameter SWNTs are longer, less prone to defects and easier to align than small diameter SWNTs and hence are potentially better for electronic applications. In this work, we have developed a simple and scalable method to disperse and sort large-diameter arc-discharged SWNTs using dithiafulvalene/thiophene copolymers. We found that by altering the number of thiophene repeating units in the polymer backbone, the polymer rigidity and wrapping conformation can be tuned, resulting in a selective dispersion of semiconducting SWNTs. From Small Angle X-ray Scattering (SAXS) measurements and Molecular Dynamics (MD) simulations, we found that the amounts of SWNTs dispersed are proportional to the available contacts sites from the polymers and the increased polymers flexibility leads to improved selectivity. Thin film transistors showed on/off ratios greater than 104 from polymer sorted SWNTs, confirming preferential sorting of semiconducting SWNTs. The sorted, concentrated and stable large-diameter semiconducting SWNT solutions have great potential for applications in TFTs, sensors and semiconductor active layer in solar cells.

[1] H. Wang *et al.*, ACS Nano, 26, pg. 2659-2668, 2013

Page 155: The abstract of A-K. Barthel et al. was omitted from the book. The work entitled “Irradiation-induced surface changes of CNT-containing polymer-based nanocomposites” will be presented as poster **P209** in Session 3 on Wednesday, June 26.

Irradiation-induced surface changes of CNT-containing polymer-based nanocomposites

Anne-Kathrin Barthel, Volker Wachtendorf, Heinz Sturm, Asmus Meyer-Plath*

*BAM – Federal Institute for Materials Research and Testing, Berlin, Germany (*asmus.meyer-plath@bam.de)*

The processing of carbon nanotubes (CNTs) and polymers into nanocomposites has been widely studied for the development of new high-performance materials. In many cases improved material properties have been found, including increased mechanical stability, electrical conductivity and reduced heat release in case of fire. It is expected that manufacturing and use of CNT-containing polymer products will steadily increase. For reasons of environmental protection and consumer safety, it is therefore necessary to examine the entire life cycle of these materials. The present study focuses on the emission propensity for nanoscale components during use and at the end of the product life. The present work used accelerated artificial weathering to examine weathering-related degradation mechanisms of CNT-containing polymers and to assess whether and under what conditions degradation might give rise to the release of individual or agglomerated nanotubes and nanoscale composited fragments. The photodegradation of nanocomposites based on polyamide, polycarbonate and polyethylene that contained multi-walled CNTs of type ″Baytubes C150P″ was studied under three different types of exposures: dry, alternating dry and wet, as well as spectrally-resolved irradiation. Resulting surface changes were evaluated with complementary chemical and microscopic characterization techniques. For sufficiently high radiation dose, substantial degradation of the polymer matrix was observed for a part of the studied polymers. It resulted in an uncovered CNT network at the sample surface. Exposed to environmental processes or used under abrasive conditions, loosely-bound CNT networks may by individualized into aerosols or liquid dispersions. Also first indications of a photooxidation of uncovered CNT networks were found. Weathered CNT-containing polymer nanocomposites may therefore become a source of CNTs that are chemically and morphologically different from the originally incorporated CNTs. By investigation of potential exposure mechanisms of CNTs in polymer composites, the present work contributes to the risk assessment of CNT-containing products.

Page 321: The abstract of Yan Li was replaced by the abstract of Luhua Li from another satellite. The correct abstract for oral presentation **C10** in CNTFA13 is:

Catalysts for controlled growth of single-walled carbon nanotubes

Yan Li

Beijing National Laboratory for Molecular Science, Key Laboratory for the Physics and Chemistry of Nanodevices, State Key Laboratory of Rare Earth Materials Chemistry and Applications, College of Chemistry and Molecular Engineering, Peking University, Beijing 100871, China (yanli@pku.edu.cn)

Catalysts play crucial roles in the chemical vapor deposition (CVD) of single-walled carbon nanotubes (SWNTs). In the past dozen years, we have worked on the catalyst design for the controlled growth of SWNTs. We studied the relation between the diameter of the SWNTs with the size and composition of catalyst nanoparticles. We developed catalysts for the growth of pure semiconducting SWNTs. By carefully designing the composition and structure of catalyst nanoparticles, we even realized the structure-specific growth of SWNTs. The chirality purities of such produced SWNTs are higher than 90%.

[1] Y. Li, R. Cui, L. Ding, Y. Liu, W. Zhou, Y. Zhang, Z. Jin, F. Peng, J. Liu, Adv. Mater. (2010) 22, 1508-1515