

JPK Instruments contact:

Claudia Boettcher: +49 30533112070

Media contact:

Jezz Leckenby: +44 (0)1799 521881

JPK reports on how graphenes are being studied using AFM to better characterize their properties at the Humboldt University in Berlin.

Berlin, 17th January 2012: JPK Instruments, a world-leading manufacturer of nanoanalytic instrumentation for research in life sciences and soft matter, reports on a keynote paper in Nano Letters where Dr Nikolai Severin and his co-workers from the group of Professor Jürgen Rabe have applied JPK's NanoWizard® system to improve their understanding of the properties of graphene.

The Physics of Macromolecules group of Professor Jürgen P. Rabe has a central research goal to correlate structure and dynamics of molecular systems at interfaces with mechanical, electronic, optical and (bio-) chemical properties from molecular to macroscopic length and time scales. Manipulation and imaging of single molecules and supramolecular systems with a scanning force microscope (SFM) is of paramount importance to the understanding of structure formation and the measurement of mechanical properties. The group is also involved in understanding and developing molecular electronics and organic electronic properties.

Within this group is Dr Nikolai Severin, recently the lead author of a paper in *Nano Letters** which shows the use of AFM in the study of graphenes. The electronic properties of graphenes depend sensitively on their deformation, and therefore strain-engineered graphene electronics is envisioned. In order to deform graphenes locally, the group has mechanically exfoliated single and few layer graphenes onto atomically flat mica surfaces covered with isolated double stranded plasmid DNA rings. Using scanning force microscopy in both contact and intermittent contact modes, they have found that the graphenes replicate the topography of the underlying DNA with high precision. The availability of macromolecules of different topologies, e.g., programmable DNA patterns render this approach promising for new graphene based device designs. Furthermore, the encapsulation of single macromolecules offers new prospects for analytical scanning probe microscopy techniques.

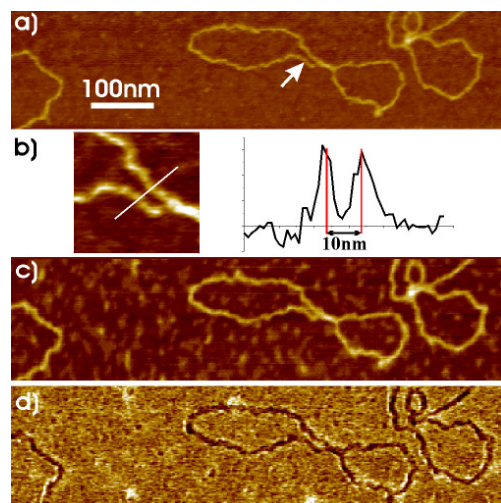
Dr Severin has seen that graphene provides enhanced protection of DNA molecules to shear forces exerted during scanning force microscopy in contact mode. In addition, graphene will act as a surface protective layer against the ambient, e.g., against oxidation, since it is impermeable to gases. Taking into account both the high electric conductivity of graphene and its extremely small thickness, this offers new opportunities for scanning probe microscopies and spectroscopies, such as scanning tunneling or tip enhanced Raman spectroscopy for analyses of both locally deformed graphene and confined molecules. Summarising, Dr Severin said, "We have successfully demonstrated that topography of graphenes can be controlled with the precision down to single molecules, i.e. graphenes are so flexible that they can replicate the topography of single molecules, when deposited on these molecules."

He also commented on some of the reasons for choosing to work with JPK NanoWizard® II for this work: "We are able to use a relatively large size of samples and scan areas of up to 30 microns. The linearized scanner is most important for us to precisely measure the height of DNA and their cross sections. The system shows little thermal drift which is

important when making measurements on such small length scales. I also found the software was quite easy to use.”

For more details about JPK’s specialist products and applications for the bio and nano sciences, please contact JPK on +49 30533112070, visit the web site: www.jpk.com or see more on Facebook: www.jpk.com/facebook.

Attachment:



*Images taken on a 6 day old sample in the area of a single graphene: (a) Topography image recorded in contact mode under a normal force of 25 nN. Arrow indicates an area enlarged on (b) with two resolved DNA strands running nearly parallel to each other at a distance of 10 nm, as visualized by the inserted cross section. (c) Intermittent contact mode topography image acquired a few minutes after (a) with the same tip. (d) Intermittent contact mode phase contrast image of the same area.**

For a high resolution copy of the image, either right click to download or contact Jezz Leckenby at Talking Science.

* Reference acknowledgment:

Replication of Single Macromolecules with Graphene, N . Severin^{*†}, M. Dorn[†], A. Kalachev[‡], and J. P. Rabe^{*†}; [†]Department of Physics, Humboldt-University Berlin, Newtonstrasse 15, 12489 Berlin, Germany. [‡]PlasmaChem GmbH, Rudower Chaussee 29, 12489 Berlin, Germany; *Nano Lett.*, 2011, 11 (6), pp 2436–2439; DOI: 10.1021/nl200846f; Publication Date (Web): May 16, 2011; Copyright © 2011 American Chemical Society

About JPK Instruments

JPK Instruments AG is a world leading manufacturer of nanoanalytic instruments that enable unparalleled access at the nanotechnology level. JPK was recognized as Germany's fastest growing nanotechnology company in 2007 and 2008 (Deloitte). The product portfolio is based around atomic force microscopes and optical tweezers for a wide range of applications, from soft matter physics to nano-optics, from surface chemistry to cellular and molecular biology. Leading-edge instruments from JPK are used by the most renowned research institutes across the world. Headquartered in Berlin and with operations in Dresden (Germany), Cambridge (UK), Singapore, Tokyo (Japan) and Paris (France), JPK maintains a global network of distributors and support centers and provides on the spot applications and service support to an ever-growing community of researchers.



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JPK Instruments AG
Bouchéstrasse 12
Haus 2, Aufgang C
Berlin 12435
Germany
T +49 30533112070
F +49 30 5331 22555
www.jpk.com
cl.boettcher@jpk.com

Talking Science Limited
39 de Bohun Court
Saffron Walden
Essex CB10 2BA
United Kingdom
T +44 (0)1799 521881
M +44 (0)7843 012997
www.talking-science.com
jezz@talking-science.com