Proceedings of the E-MRS 2006 Symposium E: Science and Technology of Nanotubes and Nanowires

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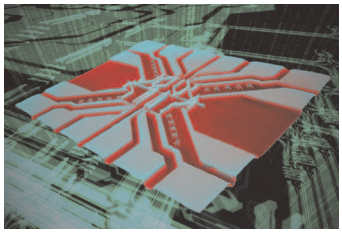

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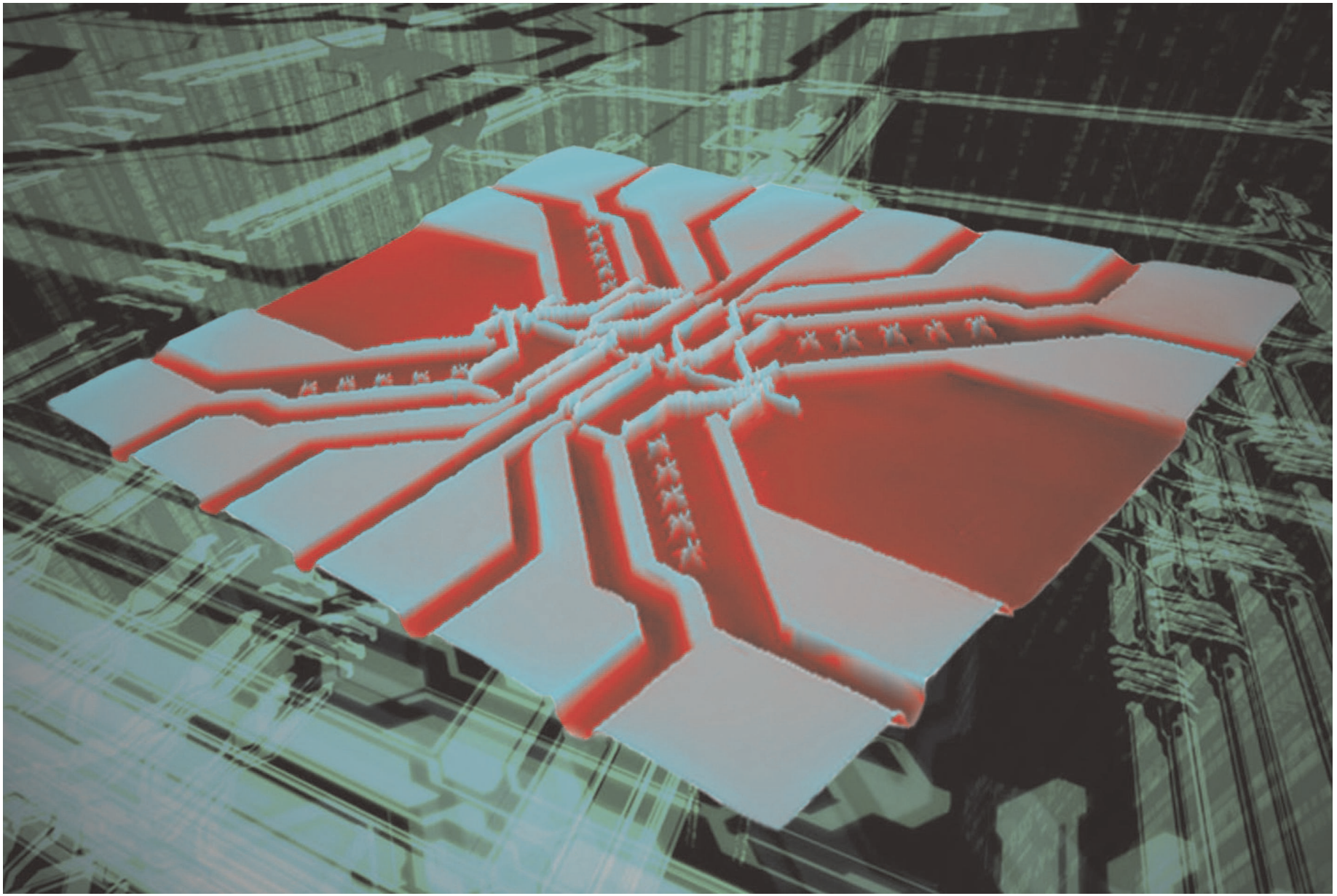
Artistic rendering of a secondary-electron image of a carbon nanotube-based array of field effect transistors. (Courtesy of M. Cantoro, University of Cambridge).



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Preface

Science and technology of nanotubes and nanowires

The successful application of nanomaterials for nanotechnology faces four main challenges: materials preparation, characterization, device fabrication and integration. The physical properties of nanomaterials strongly depend on their atomic-scale structure, size and chemistry but also on their organization and aggregation. Nanotubes and nanowires dominate the pursuit for materials for future nanotechnology applications.

Carbon nanotubes are a unique platform for many fundamental studies of quantum physics in low-dimensional systems, and several unexpected physical phenomena have been discovered. Recent breakthroughs in high-yield production, diameter control and techniques for separating metallic and semiconducting nanotubes promise to make commercial applications of this materials real. Large efforts in the area of chemical modification and manipulation of nanotubes have allowed the design and fabrication of well-controlled nanotube architectures. Substantial progress also has been made in fabricating electronic and photonic devices, sensors, field-emission displays, and nano-electro-mechanical systems using nanotubes and nanotube-based mesostructures.

One-dimensional semiconductor nanowires are also receiving ever-increasing attention because of their potential applications in electronics and photonics. Device performance typically depends on the material structure and crystallinity, but assembly is also a critical issue for applications. Fabrication of several types of 1D nanostructures, such as nanowires, nanorods, nanosaws and nanoribbons, has been successfully demonstrated by several growth methods for elemental semiconductors, such as Si and Ge, as well as for III–V and II–VI compounds. Nanotubes of various non-carbon materials have been found and characterized.

This volume contains the proceedings of the European Materials Research Symposium on science and technology of nanotubes and nanowires held May 29–June 2, 2006—in the Acropolis Congress Center, Nice, France. The symposium was chaired by Andrea Ferrari, Achim Hartschuh, Niels de Jonge, Christian Schoenenberger, Peter Eklund. The invited speakers were Adrian Bachtold (Instituto de Microelectrónica de Barcelona, Spain), Rodrigo Capaz (Universidade Federal do Rio de Janeiro, Brazil), Silvano De Franceschi (TASC National Laboratory, Italy), Mildred Dresselhaus (MIT, USA), Dmitri Golberg (National Institute for Materials Science & University of Tsukuba, Japan), Ralph Krupke (Forschungszentrum Karlsruhe, Germany), Yu-Ming Lin (IBM T.J. Watson Research Center, USA), Liberato Manna (National Nanotechnology Lab, Italy), Francesco Mauri (Université Pierre et Marie Curie, France), Marcos Pimenta (Universidade Federal de Minas Gerais, Brazil), Stephanie Reich (MIT, USA), Lars Samuelson (Lund University, Sweden), Reshef Tenne (Weizmann Institute of Science, Israel), Peidong Yang (University of California-Berkeley, USA).

The symposium covered the progress in design, manufacturing and characterization of nanotubes and nanowires, and new developments leading to possible commercial applications of these materials. In particular, several session focussed on

- progress in the synthesis of nanotubes/nanowires;
- progress in the assembly of nanotubes/nanowires into well-controlled architectures;
- light absorption, emission, and scattering;
- excitons, phonons, band structure and optical spectra;
- novel characterization techniques;
- theoretical modeling of growth, electronic and optical properties;
- fabrication and characterization of nanotube/nanowires electronic/optoelectronic devices, sensors, actuators;
- nanocomposites with nanotube/nanowires fillers;
- applications and commercialization of nanotube/nanowires;
- health/toxicity related issues.

We hope that these proceedings will provide the readers with a survey of most recent developments in these exciting fields of nanotechnology.

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The symposium was sponsored by:

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