

NANONETWORK MATERIALS

Fullerenes, Nanotubes, and Related Systems

Kamakura, Japan 2001

EDITORS

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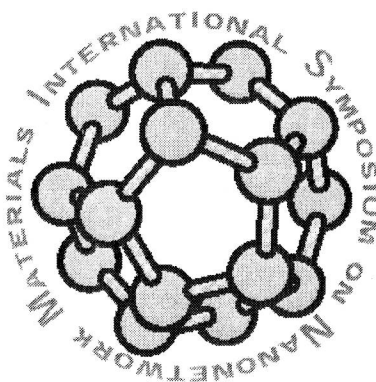
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Preface

Fullerenes, nanotubes, and related covalent-bond network materials are now the subject of great interest owing to their topology-dependent novel physical and chemical properties and to their potential for a variety of applications. In this growing field of science and engineering, both theorists and experimentalists have made many significant contributions. Some of them were of essential scientific importance, others were technologically important enough to stimulate further intensive research in the field, and others were both.

In 1970, the first scientific paper on the C_{60} cage was written by E. Osawa, who theoretically discussed physical and chemical properties of this unusual all-carbon cluster having the truncated icosahedron geometry. It took as long as fifteen years for this C_{60} to be first experimentally detected in the cluster beam by H. W. Kroto, R. E. Smalley and coworkers in 1985. Thereafter, some theorists discussed one of the most important aspects of the C_{60} fullerene and its endohedral derivatives, i.e. the possibility to use them as atomlike building blocks of materials: $La@C_{60}$ by A. Rosén and $K@C_{60}$ by S. Saito. This dream of theorists was realized in 1990 by W. Krätschmer and coworkers, who produced the crystalline solid C_{60} where C_{60} fullerenes form a close-packed lattice. Once the existence of fullerenes became definite and they became available in macroscopic amounts, they have been studied extensively during the last decade and have proved to be actually the novel atomlike building blocks of a new class of hierarchical materials: They can form van der Waals solid, molecular magnet, insulating ionic compounds, ionic but metallic compounds, covalent-bond crystalline materials (polymerized C_{60}), and even the high-transition temperature (T_c) superconductors. A recent hole doping into solid C_{60} achieved via field-effect transistor configuration by B. Batlogg and coworkers is found to give rise to the T_c of as high as 52K.

From the viewpoint of the dimensionality of materials, C_{60} and other fullerene families can be classified as zero-dimensional (0-D) network of sp^2 C atoms, being different from the two-dimensional (2-D) network graphite. Another new-dimensionality sp^2 C material, i.e. the one-dimensional carbon nanotube which fills the gap between 0-D fullerenes and 2-D graphite, was discovered by S. Iijima in 1991 without preceding work by theorists. On the other hand, immediately after the discovery, its unusual electronic transport property, i.e., the topology-dependent semiconducting or metallic electronic structure, was theoretically predicted by three groups [N. Hamada, S. Sawada, and A. Oshiyama; K. Tanaka, K. Okahara, M. Okada, and T. Yamabe; R. Saito, M. Fujita, G. Dresselhaus, and M. S. Dresselhaus]. This fascinating prediction, confirmed later experimentally, triggered further intensive research of nanotubes and they are now studied as key materials of nanoelectronics. Also their mechanical and chemical properties are of high importance in connection with various applications.

Now it is a world-wide trend to support the research on nanoscience and nanotechnology and fullerenes and nanotubes are the most important materials in the field. The Japanese Government (Ministry of Education, Culture, Sports, Science and Technology) has supported this fruitful field via a program called Grant-in-Aid for Scientific Research on Priority Area during the period of as early as 1993 to 1995, and from 1998 to present. As a part of the present project "Fullerenes and Nanotubes", the International Symposium on Nanonetwork

Materials, Fullerenes, Nanotubes, and Related Systems was held in Kamakura, Japan from January 15 to 18, 2001. This proceedings book contains most of the invited and contributed papers presented during the Symposium and consists of the following seven chapters:

- I. Nanotubes: Synthesis
- II. Nanotubes: Electronic and Mechanical Properties
- III. Fullerenes and Fullerides
- IV. Fullerene Polymers
- V. Endohedrals
- VI. Clathrates
- VII. Other Molecular Materials

The Symposium could provide an international forum for the discussion of the current status and future prospects of the nanonetwork materials. We, the organizers, would like to express our gratitude for the support from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

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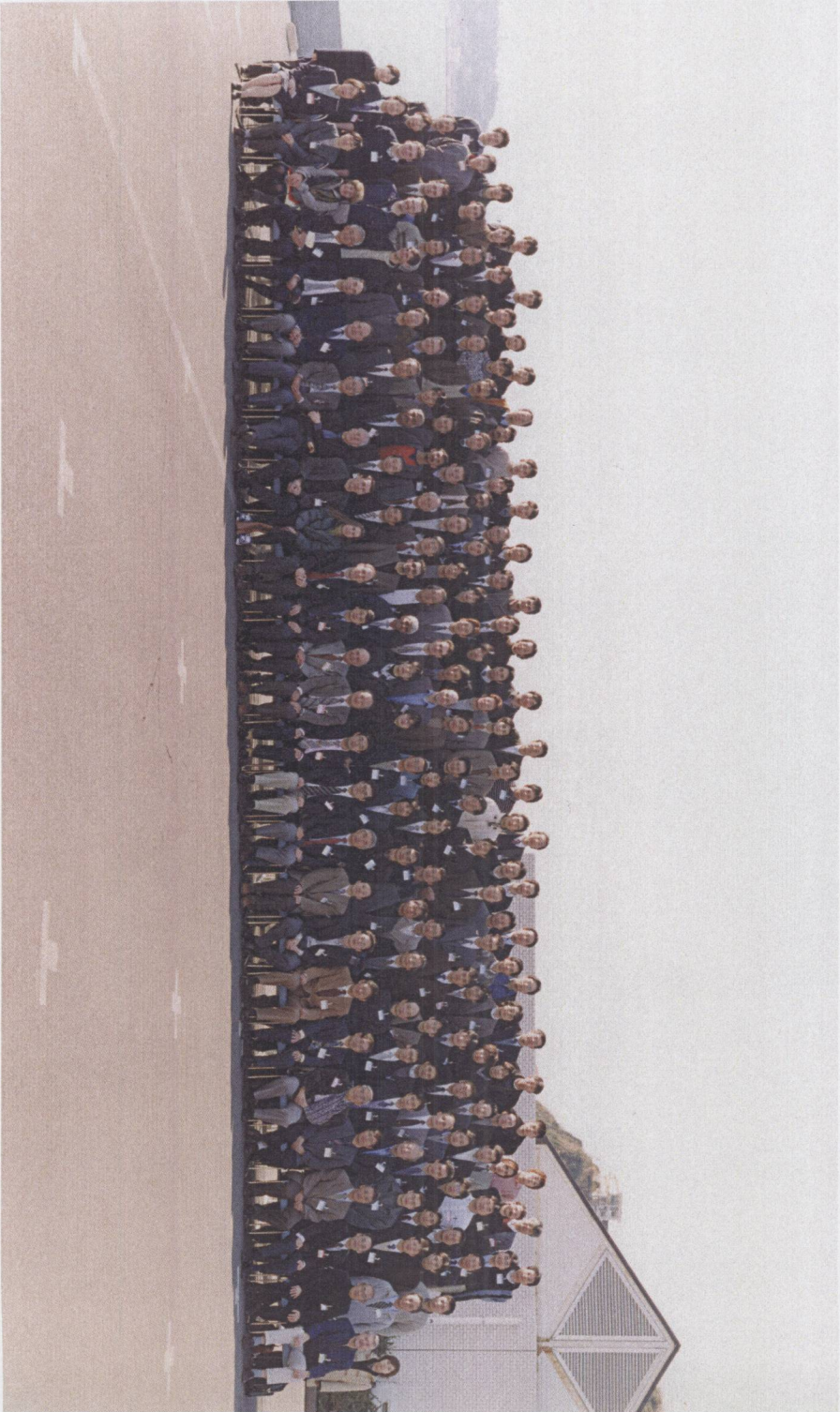
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