Superconductors (SCs) are attractive materials in all respects for any community. They provide a deep insight into the physical properties of the condensed matter and also have useful applications as ultra-low-power-dissipation systems that can help resolve the present energy problems. In particular, the recent advancement of carbon-based new superconductors (CNSCs) is significant. Before 2004, the superconducting transition temperature (T_c) of carbon-based SCs was below 1 K, except in fullerene clusters. In 2004, a Russian group discovered that diamond highly doped with boron could be an SC at $T_c = 4$ K. The following year, a group from Cambridge found that calcium-intercalated graphite could be an SC with $T_c = 11.5$ K. In 2006, the editor's group from Japan also discovered that an entirely end-bonded carbon nanotube could be an SC at $T_c = 12$ K. Since then, research on CNSCs has increased notably.

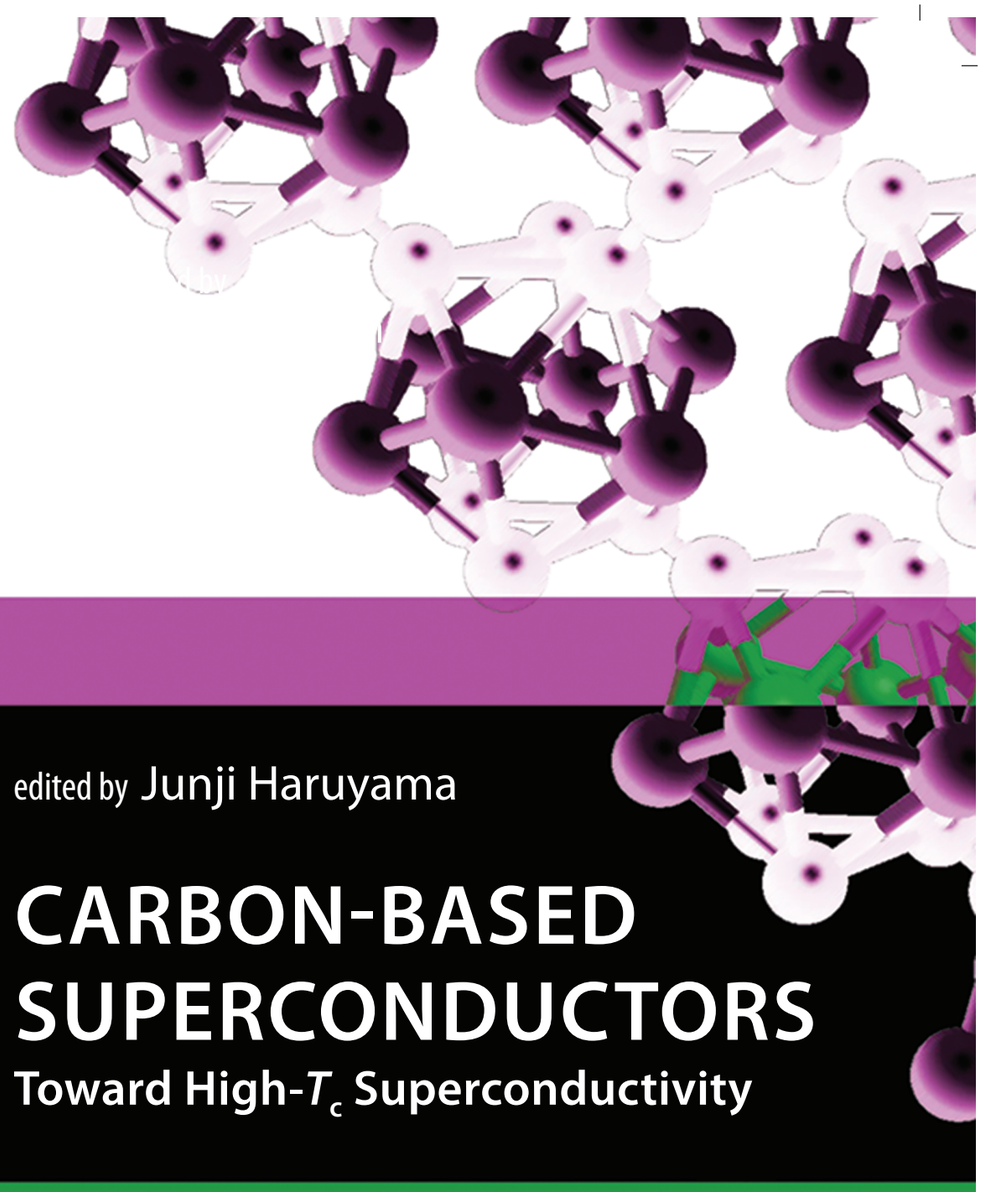
A small mass of carbon can produce high phonon frequency and high Debye temperature and can open doors to high-T_c superconductivity like that of CuO_2- and Fe-based SCs, which were the only SCs to show $T_c = 40$ K in the past. CNSCs, such as diamond, graphite, carbon nanotubes, fullerenes, and others, are a very new field of research, and this book is the first to describe their basic physics and the recent advances in this field.

Junji Haruyama is associate professor of materials science at the Faculty of Science and Technology, Aoyama Gakuin University, Japan, since 1997. He graduated from Waseda University, Tokyo, Japan, in 1985, after which he joined NEC Corporation, Japan. He received his PhD in physics from Waseda University in 1996. During 1995–1997, he worked with the University of Toronto, Canada, and Ontario Laser and Lightwave Research Center, Canada, as a visiting scientist. He was also a visiting professor at NTT Basic Research Laboratories, Japan, and the Institute for Solid State Physics, the University of Tokyo, Japan, in 2003. Prof. Haruyama has discovered the world's highest T_c and one-dimensional superconductivity in two different types of carbon nanotubes (CNTs); large energy bandgaps in CNT-derived graphene nanoribbons; and spontaneous spin polarization at graphene edges (flat-band ferromagnetism) and the spin-based phenomena arising from it. He has authored over 27 books and over 100 peer-reviewed journal articles and has five patents to his credit. He has been honored with several grants by the Japan Science and Technology agency and the Japan Society for the Promotion of Science. His main research interest is the study of nano phenomena (e.g., low-dimensional electron correlation, spintronics, superconductivity, single electron tunneling, and quantum [information] devices) in nanomaterials such as graphene, CNTs, nanowires, and compound semiconductors and their applications to novel quantum devices.

CARBON-BASED SUPERCONDUCTORS Haruyama

PAN STANFORD PUBLISHING
www.panstanford.com

V153
ISBN 978-981-4303-30-9
9 789814 303309



edited by Junji Haruyama

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