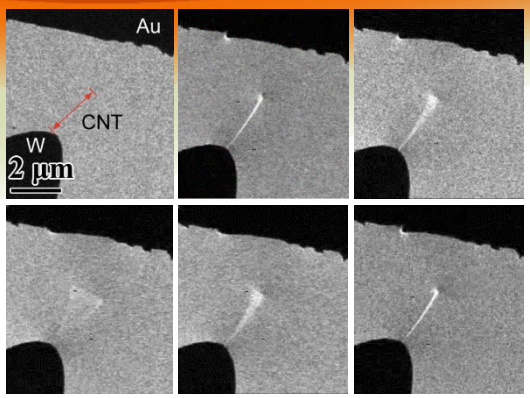
Nanostructured Carbon Electron Emitters and its Applications



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Description

Carbon forms a variety of allotropes (structures) due to the diverse hybridization of s- and p-electron orbitals, time-honored graphite (two-dimensional structure) and diamond (three-dimensional network), new forms such as C60 fullerene (cage structure), nanotube (quasi-one-dimensional structure), graphene (truly two-dimensional network), and carbyne (truly one-dimensional chain). The family of new allotropes (fullerene, nanotube, graphene, carbyne) are called "nanostructured carbon" or "nanocarbon". They exhibit extreme properties, e.g., ultrahigh mechanical strength, ultrahigh charge carrier mobility, high thermal conductivity and so on, thus attracting considerable attentions for electronic and mechanical applications as well as in basic materials science for exploring new physics and chemistry.

Carbon nanotube (CNT) and graphene possess excellent properties as electron field-emitters owing to their excellent properties. Electron sources are important in a wide range of areas from basic physics and scientific instruments to medical and industrial applications. CNT and graphene are unique as field emitters and offer several benefits compared to traditional cathodes (e.g., thermionic and photocathodes). Field emission produces very intense electron currents from a small surface area with a narrow energy spread, providing a highly coherent electron beam. The combination of the high current, the small source size and the narrow energy distribution not only provides us with the brightest electron sources but also explores a new field of electron-beam related research.

This book describes recent progress of research on nanocarbon field electron emitters ranging from fundamental properties to promising applications, e.g., X-ray sources, vacuum electronic devices, space thrusters and so on.

About the Editor

Yahachi Saito received his doctorate in Engineering from Nagoya University in 1980 and had held professorial positions at Toyohashi University of Technology (1981-1985) and Mie University (1990-2004) in addition to Nagoya University (1985-1990, 2004-2018). He had also spent time as a visiting scientist at AT&T Bell Laboratories. He is now a fellow at Toyota Physical & Chemical Research Institute.

Saito's area of expertise encompasses the synthesis, characterization and application of nanometer scale materials, especially inorganic atomic clusters and fine particles, fullerenes, carbon nanotubes (CNTs) and graphene. He has studied CNT field emitters since 1996, collaborating with Noritake Itron Corp since 1997 for the development of display devices using CNTs as a cold cathode. They demonstrated the world's first CNT-based display device at the SID International Conference in 1998. Saito is the recipient of a number of awards, including the Yazaki Arts and Science Award (2004), the Prize for Science and Technology of the Ministry of Education, Culture, Sports Science and Technology (2006), the 2007 SID Int. Symp. Distinguished Paper Award, and Fellow of Japan Society of Applied Physics (2008). 278 publications in peer-reviewed journals and 5 books.

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