Conference Abstracts

10-Physical and Chemical Properties of Materials in Relation to Structure (Superconductors, Fullerenes, etc)

Fig. 1 A SEM image of the carbon nanotubes.

PS-10.02.10 NEGATIVELY CURVED STRUCTURES: FLEXI-CRYSTALLOGRAPHY
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The discovery of C\(_60\), C\(_{70}\), cylindrical graphite and other fullerenes has opened the field of a new kind of materials with important properties. Starting from the concepts of 2-D manifolds or surfaces, negatively curved graphite structure are proposed. In C\(_{60}\), the positive Gaussian curvature is due to the presence of pentagonal rings of carbon. We have found that introducing rings with more than six carbon atoms, periodic graphite structures with the same topologies as truly periodic minimal surfaces can be constructed. Geometric properties and stability of these hypothetical structures are discussed. In general, the decoration of surfaces with different Gaussian curvatures (flexi-crystallography) allows us to characterize structures already known and propose others waiting to be discovered.

PS-10.02.11 XAPS STUDIES ON Nb-DOPED C\(_{60}\) SUPERCONDUCTORS
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The breakthroughs in synthesizing large amounts of Babntin fullerene C\(_{60}\) and other fullerenes have made it possible to study their structures and properties. The Katscher, L.D. Lamb, K. Tsairopoulos and B. Helfman, Nature, 1993, 363, 364-368. Since the discovery of superconductivity in alkali-metal-doped compounds of C\(_{60}\) molecule, a number of intensive studies concerning the crystal structures have been reported based on powder and single-crystal x-ray diffraction and x-ray absorption fine-structure (XAFS) methods. P.W. Stephens, L. Milbey, J. B. Willet, S. H. Huang, B. B. Koren, F. Diederich, R. L. Whetten and K. Holczer, Phys. Rev., 1992, B45, 543-561. The purpose of the present work is to investigate the local structure around the Nb ions in Rb\(_{1-x}\)C\(_{60}\) in order to clarify the relationship between the structure and superconducting phenomenon.

C\(_{60}\) powder were prepared by arc-heating of graphite under a 100-Torr He atmosphere and were subsequently separated chromatographically using an activated alumina column with hexane/ether developer. The purity of the C\(_{60}\) was confirmed to be at least 99% by UV-VIS and NMR spectra. The C\(_{60}\) (25 mg) was placed in a pyrex tube (6 mm diameter) together with Nb. The small amount of Nb metal were measured in metal-filled glass capillary tubes (0.5 mm diameter), which were cut and handled under a nitrogen atmosphere in a glove-box. The pyrex tubes containing C\(_{60}\) and the Nb were degassed to 10\(^{-2}\) Torr and sealed. These were then heated at 513 K for 64 hr. The transition temperature (Tc) was confirmed to be 27 K by a SQUID magnetometer (SHE SQUID). XAPS measurements were performed using synchrotron radiation from the Photon Factory (PF) at the National Laboratory for High-Enery Physics (KEK, Tsukuba). The rubidium K-edge XAPS spectra of a superconducting Rb\(_{1-x}\)C\(_{60}\) and reference sample rubidium hydrogen L-tartrate (RbH\(_2\)L\(_2\)) were taken with the transmission mode at various temperatures from 10 to 300 K.

Figure 1 shows the Rb K-absorption spectra of (a) superconducting Rb\(_{1-x}\)C\(_{60}\), (b) air exposed Rb\(_{1-x}\)C\(_{60}\) (non-superconducting) and (c) RbH\(_2\)L\(_2\) at room temperature. The results of the EXAPS will be discussed in the presentation.

Fig. 1 Rubidium K-edge X-ray absorption spectra of (a) superconducting Rb\(_{1-x}\)C\(_{60}\), (b) air exposed Rb\(_{1-x}\)C\(_{60}\) and (c) RbH\(_2\)L\(_2\) at room temperature.

PS-10.02.12 MOLECULAR PACKING AND DISORDER IN C\(_{60}\)2C\(_{81}\)H\(_{39}\)O\(_{2}\) COMPLEX.
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