TEM Studies of Nanocarbons and Nanodiamonds

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Nano-sized polymorphs of carbon continue to attract much attention of scientists and provide new targets of examination with transmission electron microscope (TEM). We present here TEM images of a number of nanocarbons which played critical roles in some stage of their R&D. Emphasis is placed on nanodiamonds.

Mechanical Alloying. Recently, primary particles of detonation nanodiamond (ND) having an average size of 4.3±0.3 nm of coherent scattering region became available in bulk quantities to open up vast possibility of application, for example reinforcement in resin composites and alloys. Critical problem here is how to create and maintain nano-dispersion of the reinforcement component. One of the initial attempts toward the dispersion problem included dispersing loose aggregates of ND in copper. Surprising success in the mechanical alloying of this combination promised quite large effects of dispersing small amounts of ND on the strength of reinforced copper.

Diamond from Soot. A potentially promising route of converting primary particles of combustion soot (defective multi-shell fullerenes) into nanodiamond having corresponding sizes by low-voltage high-current electron beam (LVHCEB) irradiation is in progress in our laboratories. We have recently succeeded in observing intermediate in the above conversion, carbon nano-onion, formed under possible catalysis of copper.

Short Carbon Nanocylinders. For some applications of carbon nanotubes, the tubes need not be too long but short ones suffice, as in the cases of reinforcements for electric-conductive plastics and light metals. One of the convenient ways of cutting long tubes in short cylinders having nano-sized long axes would be to mill with microbeads. We find that hard and heavy microbeads from yttrium-stabilized zirconia is leave sharp open ends in the cylinders after the milling for short time.