SYNTHESIS OF CARBON CLUSTERS AND INORGANIC THIN FILMS BY LOW TEMPERATURE PLASMA CVD UNDER ATMOSPHONIC PRESSURE

Hideomi Koinuma

The Research Laboratory of Engineering Materials
Tokyo Insitute of Technology
Nagatsuta, Midori-ku, Yokohama 226, Japan

We have developed new torch-type plasma generators to make low temperature material processings possible in open air conditions. As illustrated below, a cylindrical plasma CVD apparatus is composed of a metal needle acting as the cathode at the center and a grounded cylindrical anode. The inner surface of the anode was lined by a thin insulator nozzle. A low temperature homogenous plasma was generated by applying rf voltage to the needle cathode under a constant flow of atmospheric pressure He or Ar. The plasma generated in the insulator nozzle was released to open air. This cold plasma torch has been verified or expected to be applicable for such purposes as those depicted below.

Fullerene was found to be formed by the analyses with HPLC and TOF-MS in the soot produced by introducing a vaporized aromatic hydrocarbon into the after-glow region of the plasma with Te and Tg at about 1.9eV and 400℃, respectively. Different from the conventionally employed arc-plasma, which decompose graphite into fullerenes at much higher temperatures, this is a polycondensation reaction that wraps up small molecules into a large molecule. Therefore, the method may be extended to the synthesis of substituted and encapsulating fullerenes by adding a third compound in the plasma.