Water Dispersible Carbon Nanoparticles Synthesis by Pulsed Arc Discharge Plasma under High Pressure Argon with Aqueous Solution

M. Goto, Y. Hayashi, N. Takada and H. Kanda

Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan

mgoto@nuce.nagoya-u.ac.jp

The arc discharge method has been widely used for preparation of carbon materials such as fullerenes and carbon nanotubes [1, 2]. In most cases, carbon materials synthesis by arc discharge performs at low pressure condition. In this work, pulsed arc discharge plasma was generated at aqueous solution surface under pressurized argon above atmospheric pressure. Discharge at these conditions can induce different physical mechanism and chemical reaction from discharge at low pressure condition and expect to synthesize of new carbon materials with new value.

Figure 1 shows diagram of inside of the reactor. The cylindrical copper electrode set at 3mm above the liquid surface which contained organic material. A voltage was applied to the copper electrode charged by DC power supply and pulsed arc discharge plasma was generated from electrode in gas phase to liquid cathode. The experiment was conducted at higher pressure argon than atmospheric pressure.

Glycine ($CH_2(NH_2)COOH$) which used as the souse of carbon was dissolved in distilled water (100 g/L). Pressure dependence of the liquid product after 10,000 pulsed discharges is shown in Fig.2. Carbon nanoparticles were produced by discharge only at high pressure condition. Discharge at the argon pressure less than 1.5 MPa did not yield these materials. Carbon materials formed by discharge at high pressure argon were spherical particle whose diameter was 100 nm or less. Generally, it is difficult to disperse carbon materials in water without chemical modification treatment. However, carbon nanoparticle produced by this experiment could retain high dispensability. It meant that this method enabled carbon nanoparticle synthesis and chemical modification in one step.

[1] W. Kratschmer, Nature **347** (1990) 354
[2] S. Iijima et al., Nature **354** (1991) 56

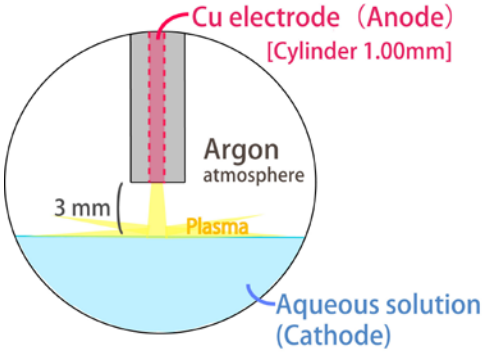

Fig. 1 diagram of inside of the reactor

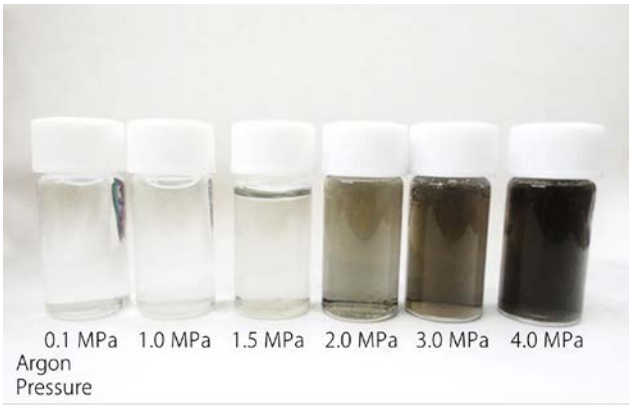

Fig. 2 Pressure dependence of the product.