

Characteristic structure differences of carbon particles by the preparation methods

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Many types of carbon and carbonaceous materials have been proposed to explain the 217 nano meter feature. One of the most plausible interstellar dust is the so called 'dark QCC', which formed from an ejecta of methane plasma. Studies on the view point of the growth on these carbonaceous grains have hardly done.

In this paper, the carbon particles were produced in methane gas by using the conventional carbon arc-discharge. The plasma field effects by passed through the carbon grains have been presented. Typical amorphous grains have been produced by the evaporation of carbon in Ar gas. If the carbon grains were produced in the methane gas atmosphere, QCC like grains without the central hole have been predominately produced. The QCC like grains became strong onion-like structure by the heating at 260 degrees centigrade in vacuum. By the increasing of the heating temperature up to 550 degrees centigrade, the strong onion-like structure gradually changed to the graphite sheet by the surface coalescence among the strong onion-like grains. Above structure changing process have been observed directly by in-situ observation using high-resolution electron microscope. The heating system was the special designed specimen heater fitted on our electron microscope.

If we passed through the grains produced in the methane gas into the plasma region, the grains contained the beta-carbide have been predominately produced. The IR spectra showed the characteristic absorption peak 9.2 micro meter ($=C=C=$) and 7.9 micro meter (HCCH). These peaks never observed produced grains in methane gas atmosphere and Ar gas atmosphere. The C60 grains were produced in Ar and He gas atmosphere.

Carbon atoms can form three types of bonds with other carbon atoms. The first type is formed from sp^3 hybridization (hereafter sp^3-C), the second type from sp^2 hybridization (hereafter sp^2-C), and the third type from sp hybridization (hereafter $sp-C$). A pi bond and a sigma bond (sp^2-C) make a carbon double bond, and two pi bonds with a sigma bond ($sp-C$) make a carbon triple bond. pi-electrons are the electrons that make these pi-bonds.

It can be concluded that the various carbon grains can be produced by selection of gas atmosphere and plasma field.