Correlation between infrared spectra of magnesium compounds and shape of the grains

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In order to clarify the correlation between the shape of MgO particles and infrared spectra, spherical or ellipsoidal particles have been produced by heating cubic MgO particles. When the shape of the particles changed into sphere from cube, the main peak in IR spectra shifted to 18.8 micrometer from 20 micrometer. IR spectra of the ellipsoidal particles showed a peak at 23 micrometer in addition to the peak at 18.8 micrometer. It was found that the IR spectral changes could be explained on the basis of the difference of the particle shape. The shape dependence on absorption spectra of MgO and MgS will be discussed with the comparison of the 30 micrometer emission feature seen in the C-rich post-AGB.

The 30 micrometer emission feature have been observed in the carbon-rich post-asymptotic giant branch. In order to clarify the candidate causing 30 micrometer emission features, infrared spectra of a various material have been measured. The candidates of the feature are widely believed to be attributed to MgS at present. Szczerba et al. (1999; A&A, 345, L39-L42) calculated the spectra of MgS grains from the bulk data on the basis of the assumption that MgS grains are composed of a different shape. They reported that the 30 micrometer feature can be reproduced by grains of pure MgS provided that they have a broad distribution of shapes. However, infrared spectra of MgS grains consisting of a different shape are not obtained because the formation of these MgS grains is very difficult.

Possibly no other solid than MgO has been studied so much for the purpose of examing the correlation between particle shape and infrared spectra. The reason for this may be with the ease which a highly crystalline cubes of MgO are simply produced by burning Mg ribbon in air. Although a calculation to obtain absorption spectrum is performed on the assumption that the shape of MgO particles are cubes or shere, the effects of spectrum due to a different particle shape is not sufficiently discussed because it was impossible to be produced the spherical MgO particles.

In order to clarify the correlation between the shape of particles and infrared spectra, spherical or ellipsoidal MgO particles have been produced by heating cubic MgO particles or by keeping cubic particles in air. IR spectra of those MgO particles have been measured. When the shape of the particles changed into sphere from cube, the main peak in IR spectra shifted to 18.8 micrometer from 20 micrometer. IR spectra of the ellipsoidal particles showed a peak at 23 micrometer in addition to the peak at 18.8 micrometer. It was found that the IR spectral changes can be explained on the basis of the difference of the particle shape.

The structures of MgO and MgS consist of a similar cubic. Therefore, it is conceivable that the tendency of IR spectral feature of MgS particles bear a resemblance to that of MgO particles, although the peak position of MgS is different from that of MgO. The shape dependence on absorption spectra of MgO and MgS will be discussed in addition to the comparison of the 30 micrometer emission feature seen in the carbon-rich post-asymptotic giant branch.