

Presolar grains: Simultaneous formation of SiC and graphite

Takeshi Chigai[1], Tetsuo Yamamoto[2]

[1] Earth and Planetary Sci., Nagoya Univ., [2] Earth and Planetary Sci., Nagoya Univ

<http://epp.eps.nagoya-u.ac.jp/~chigai/>

It is known from the isotopic studies that one of the plausible birth places of presolar SiC and graphite grains is the outflowing gas around carbon-rich AGB stars (hereafter, referred as carbon stars). Furthermore, the infrared observations of carbon stars reveal the 11-micron emission feature, indicating the presence of SiC grains. On the other hand, the condensation theory predicts that the condensation temperature of SiC in carbon star envelopes is always lower than that of graphite in the plausible physical conditions of the carbon star envelopes. When graphite condenses prior to SiC, carbon atoms are consumed up by condensation of graphite and no carbon is available to form SiC. As a results, SiC grains do not condense around carbon stars. To resolve this question, we noticed the temperature difference between the gas and the grains, and found that condensation of SiC grains was able to precede that of graphite grains. The difference of temperatures results from the difference of the optical properties of grain materials. We explore various possibilities of formation of SiC and graphite around carbon stars such as (1) simultaneous formation of SiC and graphite, (2) formation of SiC only, and (3) formation of graphite only. Discussion is given on their conditions.