

Observations of the 11 μm Silicon Carbide Feature in Carbon Star Shells

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Silicon carbide (SiC) is known to form in circumstellar shells around carbon stars. SiC can come in two basic types — hexagonal α -SiC or cubic β -SiC. Laboratory studies have shown that both types of SiC exhibit an emission feature in the 11–11.5 μm region. Such a feature can be seen in the spectra of carbon stars. The size and shape of the feature can vary depending on the type, size and shape of the SiC grains. Silicon carbide grains have also been found in meteorites. The aim of the current work is to identify the type(s) of SiC found in circumstellar shells and how they might relate to meteoritic SiC samples. We have used the CGS3 spectrometer at the 3.8-m UKIRT to obtain 7.5–13.5 μm spectra of 31 definite or proposed carbon stars. After flux calibration, each spectrum was fitted using a χ^2 -minimization routine. This routine was equipped with the published laboratory optical constants of six different samples of small SiC particles and had the ability to fit the underlying continuum using a range of grain emissivity laws.

It was found that the majority of observed SiC emission features could only be fitted by α -SiC grains. The lack of β -SiC is surprising, in that this is the form most commonly found in meteorites. Included in the sample was the extreme carbon star AFGL 3068, previously known to show the 11 μm SiC feature in absorption. In addition to it, we have discovered three IRAS sources, all of which have been proposed to be carbon stars, that also appear to show the SiC feature in absorption.