Classification of C-Rich Stars According to Their Mid-IR Signatures

R. Papoular
Service d'Astrophysique, CEN-Saclay, 91191 Gif-sur-Yvette Cedex, France

The spectra of the IRAS low-resolution-spectrometer in tape form have been submitted to a systematic morphological analysis, using classical quantitative discriminants (O.Gal et al. 1987, A & A 183, 29; Y. Baron et al. 1987, A & A 186, 271; R. Papoular 1988, A & A , in press). Spectra which display the 11.5μ feature of SiC fall into 4 classes of average spectral excesses. They differ by the width of the SiC feature and by the presence or absence of secondary features at ~8.6, ~11.7 and ~12.8μm.

A majority of these spectra have a lower 12-25μm colour temperature than do most optically selected C-stars, presumably because of thicker dust envelopes. While most spectra belong to LRS class 4n, 20% of the total were found among the brightest 20% of the much larger class 1n, suggesting that the relative abundance of C-stars is much higher than previously assumed.

Besides SiC, the dust appears to include graphitic and amorphous hydrogenated carbon (HAC), the latter being responsible for the secondary features. Here are the distinctive features of the 4 classes and their associations with optical spectral types in as much as these were identified.

SiC(a), fig.1. Mostly in LRS 4n, also in 1n. Late C types of the disc component. The SiC feature nicely matches the extinction curve for the purest and finest grains of laboratory α-SiC. The relative intensities of the secondary bands with respect to the SiC band increase as the colour temperature decreases, but remain constant with respect to the CS continuum. $F_{100\mu}/F_{60\mu}$ is often > 1.

SiC(b), fig.2. Only in LRS 4n. Late C types of the flat component. Weaker secondary features.

SiC(c), fig.3. Mostly in LRS 1n, also in 4n. Optical types S and M of the spheroidal component. The SiC feature is wider than (a) and (b) and similar to that of polluted, coarser grains of α-SiC.

SiC(d), fig.4. Only in 4n. Irregulars of the thin disc. 8.6-μm feature shifted to the blue, 11.7 μm absent. Graphitic component dominant. High value of $F_{100\mu}/F_{60\mu}$.

https://doi.org/10.1017/S0252921100062631 Published online by Cambridge University Press