Spitzer mid-infrared spectra of carbon stars in the Large Magellanic Cloud

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We have obtained infrared spectra of 26 carbon-rich stars in the Large Magellanic Cloud (LMC), by using mid-infrared spectrometer on board the Spitzer Space Telescope. Our sample consists of relatively high-mass-loss rate Asymptotic Giant Branch (AGB) stars, and their circumstellar envelopes are well developed. Our 5-38 micron spectra cover several acetylene (C2H2) bands, as well as dust emission band of SiC and probably MgS. The metallicity of the LMC is about half of the solar neighbor. Therefore, we aim to investigate the metallicity effects on the compositions and abundances of dust grains and molecules.

The equivalent width of C2H2 is almost comparable to that of AGB stars in the solar neighbor, showing the abundance of this molecule does not decrease at lower metallicity. Because carbon atoms are synthesized in these carbon rich stars, elemental synthesis, rather than low metallicity, affects the abundance on C2H2. This molecule is the parent molecule in the PAH formation processes. Our research shows that even though at low metallicity, a large amount of the source of PAHs is expelled in the interstellar medium of the galaxies.

The equivalent width of SiC emission is larger among LMC carbon stars than galactic stars. The elemental abundance of silicon is less than that of carbon, thus, Si determines the abundance of SiC. At low metallicity, fewer Si atoms result in fewer SiC grains.

The 25-micron dust feature, presumably MgS band, is found among high mass-loss rate stars. However, we did not find any metallicity dependence. Hony et al. (2002) reported that the central wavelength of this band shifts towards longer wavelength as mass-loss rate becomes higher. However, we did not find such a tendency.