Unidentified Infrared Emission Bands and Far-Infrared Emission in Various Interstellar Medium

T. Onaka[1], M. Mizutani[1], K.-W. Chan[1], D. Tomono[2], H. Shibai[3], T. Nakagawa[4], & Y. Doi[5]

[1]*Department of Astronomy, University of Tokyo, Tokyo 113-0033, Japan*
[2]*Subaru Telescope, National Astronomical Observatory of Japan, Hilo, Hawaii 96720, U.S.A.*
[3]*Department of Physics, Nagoya University, Nagoya 464-8602, Japan*
[4]*Institute of Space and Astronautical Science, Kanagawa 229-8510, Japan*
[5]*Department of Earth and Science and Astronomy, University of Tokyo, Tokyo 153-8902, Japan*

Three regions of the diffuse interstellar medium, including two HII regions of the Carina nebula and Sharpless 171, and the ρ Oph cloud region, have been mapped with PHT-S ($2.5 - 12\mu$m) and LWS full grating scan ($45 - 170\mu$m). The unidentified infrared (UIR) emission bands (6.2, 7.7, 8.6, and 11.2 μm) were detected and their intensities were derived at most of the observed positions. Their spatial variation is examined relatively to the far-infrared intensity (FIR), which was estimated from the LWS observations. The strength of the radiation field was also derived from the temperature of the far-infrared emission. From the present observations, we found:

- The UIR band to FIR intensity ratio (UIR/FIR) decreases towards the ionized gas, whose amount was estimated from [OIII]88μm intensity, indicating that the UIR band carriers are destroyed or the emission mechanism of the UIR bands becomes inefficient in ionized regions.
- The UIR/FIR ratio does not vary systematically for $10^2 < G_o < 10^4$, where G_o is the radiation field intensity in units of the solar vicinity value. Nor systematic difference in the UIR/FIR ratio was seen for the observed three regions despite the large difference in the spectra of the energy sources (O3 stars (Carina nebula), B1-O7 stars (S171), and a B2 star (ρ Oph)), suggesting that the UIR emission efficiency does not vary with the spectrum of the incident radiation relatively to sub-micron dust grains.
- There may be a trend that the UIR/FIR ratio does increase at the interface of molecular gas in the three regions, suggesting a possible increase of the abundance of the UIR band carriers at the interface region.
- There is no systematic variation seen in the relative band ratios in the three regions (see also Chan et al. this workshop). No clear variations were seen even at the positions where the UIR/FIR ratio decreases (ionized regions) or increases (interface regions).

The UIR/FIR ratio in the three regions is quite similar to that obtained for the diffuse interstellar medium by the IRTS observations (Onaka 1999, Adv. Sp. Res. in press). Therefore the UIR band carriers are suggested to have a relatively wide absorption spectrum in the ultraviolet to visual ranges. In addition, their material properties, including the ionization and the size distribution, are suggested not to vary appreciably in a wide range of the environmental conditions. These results provide important clue to the understanding of the band carriers and emission mechanism.