Q03a Spatially Resolved 3 μm Spectroscopy of IRAS 22272+5435: Thermal Process on Hydrocarbon Dust

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We present medium resolution 3 μm spectroscopy of a carbon rich proto-planetary nebula IRAS 22272+5435. Spectroscopy with the Subaru Telescope adaptive optics system revealed a intriguing spatial variation of hydrocarbon molecules and dust surrounding the star. In the spectra sampled close to the central star are dominated by the ro-vibrational lines of acetylene (C_2H_2) and hydrogen cyanide (HCN) at 3.0 μm. The molecules are concentrated in the compact region near the center. Other absorption bands found at 3.22, 3.32, and 3.35 μm are tentatively identified with ethylene (C_2H_4) and ethane (C_2H_6) though higher resolution spectroscopy is necessary to be conclusive. The 3.3 and 3.4 μm emission features of aromatic and aliphatic hydrocarbon are detected in the detached region at 560–1300 AU away from the star. The spatial variation of the gas and dust suggests that the small hydrocarbon molecules are indeed the source of the solid material, and that the leftover gas failed to be involved with the grain formation are being observed near the central star. The intensity of aliphatic hydrocarbon feature relative to the aromatic feature decreases with the distance from the central star. The spectral variation is well matched to that of a laboratory analog thermally annealed with different temperatures.