# Cometary Dust: a perspective from mid-infrared spectroscopy

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Comets are made of ice and dust and are the frozen relics of the early solar nebula. These materials in comets are clues to investigate the environment in the early solar nebula and the formation process of planetesimals and planets.

A silicate feature is often observed in comets as a 10-$\mu$m resonant feature. In many cases, the feature shows the existence of crystalline silicate together with amorphous silicate. Since the crystalline silicate grains are generally made in the high-temperature environment from the amorphous ones, it is believed that there should have been the radial transportation of the materials in the proto-solar disk. An abundance of the crystalline dust grains was therefore expected to be smaller as far from the Sun.

Complex organic materials in comets are also important as well as ices and minerals because they are essential pieces of the puzzle regarding the evolution of organics in the proto-solar disk and the origin of life on Earth. Various kinds of complex organic molecules have been observed in warm environments ($>$ 100 K) outside the Solar System, such as hot molecular cores. If comets generally contain complex organics, it suggests the warm environment of the comet-forming region. The STARDUST sample return shows evidence for polycyclic aromatic hydrocarbons (PAHs) in the samples returned from Comet 81P/Wild. However, the detection of the PAH feature in comets is still under debate, although the possible detection of PAH feature in the mid-infrared spectra of comets 9P/Tempel 1 and C/1995 O1 (Hale-Bopp) is reported.

We have carried on infrared observations of comets to understand the formation mechanism of ice and dust incorporated into a cometary nucleus. Through our effort until now, it is revealed that the shape and strength of the 10-$\mu$m emission feature itself seem to be different from comets to comets, and there cannot be seen a major difference between Oort cloud comets and Jupiter-family comets. In this talk, I will focus on the results of mid-infrared spectroscopic observations and discuss the evolution of the cometary dust.