AKARI/IRC near-infrared asteroid spectroscopic survey: AcuA-spec

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Water is found in various forms in our solar system and is one of the most important ingredients in the origin of life. It provides evidence for the evolution of the solar system, especially its thermal history. Hydrated minerals are formed in environments where anhydrous rock and liquid water exist together, resulting from aqueous alteration. Because hydrated minerals are stable even above the sublimation temperature of water ice, they become an important reservoir to trace the water present in the history of the solar system unless they were reset by a temperature change after formation. Asteroids are considered to record the initial conditions of our solar nebula of 4.6 Ga ago. To explore the existence of water in the present solar system, it is indispensable to investigate the presence of hydrated minerals and water ice on various types of asteroids. Hydrated minerals and water ice exhibit diagnostic absorption features in the so-called 3 micron band (approximately 2.5-3.5 micron wavelength range). Many spectroscopic surveys have been conducted in the 3 micron band using ground-based observatories, which are severely affected by telluric absorption at around 2.8 micron. Space-borne observations, free from the effect, therefore, offer an excellent opportunity to study and identify the mineral species in asteroids.

The Infrared Camera (IRC) on board the AKARI satellite has a unique spectroscopic capability covering 2.5-5 microns continuously with a spectral resolution of R~100, which provides valuable data thanks to its high sensitivity and unique wavelength coverage. We conducted a spectroscopic survey of asteroids in the 3 micron band using IRC. In the warm mission period of AKARI, 147 pointed observations were performed for 66 asteroids in the grism mode in 2.5-5 microns. According to our observations, it is found that most C-complex asteroids, especially all Ch-, Cgh-, B-, and Cb-type asteroids, have obvious absorption features in the reflectance spectra at around 2.75 micron, which is attributed to OH-stretch in hydrated minerals. The peak wavelength of the 2.7 micron band feature is concentrated at around 2.75 micron: in particular, there is a correlation between the peak wavelength and the band depth among 13 C-complex asteroids. This trend can be understood in terms of the process where hydrated minerals are being heated up and gradually losing water, that is, the dehydration process.

In this talk, we present the spectroscopic survey of asteroids with AKARI for detecting the 2.7 micron absorption features and discuss scenarios for the formation and evolution of C-complex asteroids.

Keywords: asteroids, hydrated minerals, near-infrared spectroscopy

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