Changes of reflectance spectrum of olivine with metallic iron by the space weathering simulation

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Material study on the surface of asteroid using reflectance spectrum can contribute to the planetary science in respect to searching the evolution of the solar system, and connecting between meteorite and its corresponding asteroid. Reflectance spectrum at visible to near infrared wavelengths is one of the powerful remote sensing tool for searching materials on the surface of earth, planet and asteroid. For example, olivine is one of the most important rock-forming minerals for the remote sensing analysis. The reflectance spectrum of olivine at visible-NIR wavelength range shows a characteristic composite feature, where three bands absorptions overlap with one another. From this characteristic feature, it is thought that there exists olivine on the surface of many asteroids, such as S-type, Q-type, A-type and R-type.

However, there are few asteroid which reflectance spectra resemble to meteorite. Although ordinary chondrite is the most representative meteorite falling on the earth, the asteroid-type that is matched with their reflectance spectrum is quite minor. This dissociation is now thought to be due to the space weathering effects.

The space weathering effects indicate the optical changes such as spectral reddening (the shorter the wavelength, the lower the reflectance), albedo decrease and absorption band subduing. These effects are now thought to be caused by the space environment such as micrometeorite bombardment and/or solar wind.

In this report, we present the analysis of microscopic reflectance spectra of olivine using ALIS (Akita Lunar Imaging Spectrometer). In this experiment, we used olivine and olivine with metallic iron that were irradiated by a pulse laser, which is the simulation of space weathering effects.