

# The effect of specular reflection and diffuse reflection for spectral photometry

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Remote-sensing from orbital spacecraft is effective method to planetary global mapping. At the first step of a planetary survey, the global mapping is important for summarizing to the planet. But the second step, a local geological survey is an important method to elucidate the evolution of the planet. A landing is one of advantageous methods to a local geological survey. At this landing survey, macro image observation to rock minerals and matrix teach us pressure and thermal history of the rock. And distribution of rocks teaches us geological history of the region. For this purpose, NASA's Mars Exploration Rover Spirit and Opportunity carry Rock Abrasion Tool (RAT) and Microscopic Imager (MI). RAT will removes dusty and weathered rock surfaces and exposes fresh material for examination by instruments onboard. MI will obtain close-up, high-resolution images of rocks and soils. At SELENE-2, which is JAXA's next moon landing mission, an abrasion tool and a microscopic imager will be designed. These instruments are important for next step of planetary observation.

On the earth, usually a polarized microscope observes structure of rock matrix and mineral. Rock and mineral are made into thin slices that can be seen through, and transmitted light is observed. But in the space, it is difficult to make thin slices automatically. Grinding rock surface and observing the rigid surface is a realistic optical survey method. Microscopic image observation and remote-sensing observation differ in some points from each other. First, an object of remote-sensing observation is an enough thick regolith layer, but at the microscopic image observation, an object is rigid rock surfaces. At the enough thick regolith layers, diffuse reflection light is observed, but at the rigid rock surface, not only diffuse reflection but also specular reflection light is observed. Optical theory for the reflection light of thick regolith layers cannot be applied for the reflection light of rigid rock surface [Akiyama et al. (2002)]. We have to explain the effect of specular reflection for analysis microscopic image of rigid rock surface. Specular and diffuse reflection by surface roughness might be explained. We chose white and black opaque samples. We controlled roughness of samples surfaces, and measured the roughness of samples surface using AFM. We measured specular and diffuse reflections and investigated a relationship among phase angle, reflection light, and surface roughness.