Estimation of the reflectance spectra of C-type asteroids affected by solar wind proton irradiation

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Asteroids and meteorites are thought to retain information on the early solar system. In particular, planetesimals similar to C-type asteroids and/or parent bodies of carbonaceous chondrites may have carried water and organics to the earth. However, meteorites do not retain direct evidence for which parent body they come from. Nevertheless, reflectance spectra suggest that carbonaceous chondrites may be from C-type asteroids.
The surface of airless bodies, however, exhibit spectra affected by space weathering effect. Recent studies suggest that the influence of solar wind implantation cannot be ignored in near earth airless bodies [Ichimura et al., 2012]. The absorption strength around 3 μm of reflectance spectra of silicate minerals which mainly contained in carbonaceous chondrites was changed by hydrogen irradiation [Nakauchi et al., 2014]. This change strongly suggests that hydroxyl group and/or H_2O were formed by hydrogen implantation.
In this study, based on the previous our study, the spectral change by hydrogen implantation on the C-type asteroids is estimated by spectral mixing model. Only the reflectance spectra of olivine, antigorite and saponite were taken into consideration of hydrogen implantation and other reflectance spectra of minerals and carbonaceous chondrite were obtained from the RELAB database.
After hydrogen irradiation, the absorption strengths of reflectance spectra estimated by mixing model showed different changes depend on carbonaceous chondrite groups. In CI and CM chondrites, the absorption strength at 2.77 μm changed strongly. On the other hand, the weathered spectra of CR and CV chondrites showed weaker change from 2.8 μm. These differences were suggested to be useful for meteorite type estimation.
When we estimate carbonaceous chondrite types using reflectance spectra on C-type asteroids, then, the space weathering effect of solar wind protons must be considered.

Keywords: space weathring, solar wind, C-type asteroid

