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The possibility of np-Fe production by solar wind protons on the airless body surfaces.

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In HAYABUSA2 mission, we must decide the sampling site using characterization of mineralogical and textural heterogeneities on the asteroid surface by remote sensing data. The reflectance spectra of asteroidal surface have information of mineral composition, but the surface spectra was changed by weathering effects which contain the micro-impacts and the implantation of solar wind ions and cosmic ions. The spectra of S-type asteroids show the reddening and darkening, on the other hand the C-type asteroids show the bluing and darkening [1].

A lot of experimental approaches tried to reproduce the weathering effects. Sasaki et al. (2001) found the nanophase iron particles within the amorphous vapour-desposited rims of laser-irradiated olivine grains using transmission electron microscopy (TEM) [2]. On the other hand, the simulation of implantation for endmembers of lunar and S-type using H^+ ions at keV energy and MeV energy protons implantation show only small changes in visible and near infrared spectra [3, 4].

Then we simulate weathering effect for minerals that would be contained in C-type asteroid. We prepared three minerals, olivine, antigorite and saponite. The weathering simulation of solar wind protons was achieved using ion implantation device at the Wakasa Wan Energy Research Center (WERC). The total amount of implanted $H_2{}^+$ with 10 keV was 10^{18} ions/cm^2. The reflectance spectra were measured by FTIR at WERC, and the TEM observation was at Kyoto University. In our simulation, vary with previous study, olivine irradiated H^+ ions shows reddening and darkening like laser-irradiated olivine. On the other hand, another samples did not show large change. Here we report the TEM observations of $H_2{}^+$ irradiated samples.

References: [1] Nesvorny, D., et al., (2005) Icarus, 173, 132-152. [2] Sasaki, S., et al., (2001) Nature, 410, 555-557. [3] Hapke, B., et al., (2001) JGR, 106, 10039-10073. [4] Yamada, M., et al., (1999) EPS, 51, 1255-1265.

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