



Albedo/color heterogeneity on the surface of rubble pile asteroid Itokawa: Evidence for the space weathering

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Between September and November 2005, Japanese asteroid explorer Hayabusa observed S-type asteroid (25413) Itokawa, a small S-type near Earth asteroid (550m x 300m x 240m), by Asteroid Multiband Imaging CAmera (AMICA) and Near Infrared Spectrometer (NIRS). AMICA with 7 filters observed the whole surface of Itokawa with the solar phase angle around 10 degree with nominal resolution 70cm. Itokawa is heterogeneous in both color and albedo. Brighter areas are usually situated at locally elevated zones and at gravitationally steep zones, although steep zones are not always bright. AMICA color observations and NIRS observations show that brighter areas are bluer and darker areas are redder in color. No previously observed asteroids show such large variations in both albedo and color. These variations can be explained by the space weathering process and chondrite composition.

We observe that a darker surface layer should overlap the brighter area with sharp boundaries. Thickness of dark layer is less than 1m and there are unremoved dark boulders on brighter regions. This feature strongly indicates that the brighter area is formed by the removal of the surface darker materials. Medium (10-20cm) to high (1cm) resolution images show strong evidence that brighter surface was formed by removal of the overlying dark rocky layer. We confirmed that rocky meteorite surface is darkened and reddened by space weathering simulation, like particulate surface. The observed morphology that locally elevated zones like faceted rims are bright may be explained by the seismic shaking. Probably surface motion at the elevated zones would be stronger due to concentration of internally propagating waves. Rubble-pile Itokawa may have some internal coherency.