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X-Ray Fluorescence Specrometry of the Near-Earth Asteroid 25143 Itokawa by XRS Onboard Hayabusa

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X-ray fluorescence spectrometry of the S-(IV) class near-Earth asteroid 25143 Itokawa has been performed by the CCD-based X-ray spectrometer, XRS, onboard Hayabusa to determine major elemental composition of the asteroid during the rendezvous phase. We present here the preliminary results of the XRS observation, indicating that the surface of Itokawa has chondritic composition and that LL- or L-chondrites are most likely but H-chondrites or primitive achondrites cannot be rejected. Remote X-ray fluorescence or XRF technique is an application of a well established XRF method in the laboratory but the excitation source is solar X-rays. It has been proven by the Apollo missions to determine major elemental composition of the surface of atmosphere-less planets such as the Moon (e.g., SMART-1, SELENE, Cheng'E, Chandrayaan-1), the Mercury (e.g., Messenger, Bepi Colombo), and the asteroids (e.g., NEAR Shoemaker, Hayabusa). The surface composition of Itokawa has been analyzed through remote XRF spectrometry by compared method between the X-rays off the asteroid and the onboard standard sample. We have calculated the surface elemental ratios of Mg/Si and Al/Si for some sites observed by XRS during relatively enhanced solar activity. Furthermore, under the assumption that the continuum component of X-rays at Si-Ka is dominantly by the solar scattered X-rays, the absolute abundance of the Si (and correspondingly Mg from Mg/Si) can be derived. There are found relatively small regional variations in composition. We have estimated averaged elemental ratios of Mg/Si=0.78 ± 0.09 and Al/Si=0.07 ± 0.03, indicating that LL- or L-chondrites are most likely but H-chondrites or primitive achondrites cannot be rejected. Since the preliminary results have relatively large uncertainties for those composition raios, it should be carefully treated and further analysis should be needed, especially for heavier elements (such as S, Ca, Fe) other than Mg, Al, and Si.