

Three-dimensional structures of aggregate-type Itokawa particles

YADA, Toru^{1*} ; UESUGI, Masayuki¹ ; KAROUJI, Yuzuru¹ ; UESUGI, Kentaro³ ; TSUCHIYAMA, Akira² ; ISHIBASHI, Yukihiro¹ ; OKADA, Tatsuaki¹ ; ABE, Masanao¹

¹Japan Aerospace Exploration Agency, ²Graduate school of science, Kyoto University, ³Japan Synchrotron Radiation Research Institute

Regolith particles, which should have been formed by fragmentation and abrasion due to impact and impact-induced vibration, exist on surfaces of minor bodies. Their formation processes and causes will tell us physical and chemical condition of the surfaces of the minor bodies and their parent bodies.

Hayabusa spacecraft returned samples from S-type Near-Earth Asteroid (NEA) Itokawa in June 2010 (Abe et al., 2011). Among the returned regolith particles, we focus on aggregate-type particles composed of tiny component grains to analyze their three-dimensional (3D) structure in order to clarify their formation processes and environments.

In this study, we chose five aggregate-type Itokawa particles, which are 55-128 micron in size, assigned for JAXA's research among more than 400 particles initially described. They were firstly analyzed by synchrotron X-ray computed tomography (CT). Because they might be fragile, they were placed inside tiny, upside-down pyramid-shaped sample holder made of SiN. They were irradiated in beam line (BL) 47XU of SPring-8 by photon light source of both 7keV and 8keV in energy and obtained their transmitted X-ray images. The obtained images were calibrated by computers, and their 3D structure could be reconstructed. Mineral species in the particles could be estimated by the different X-ray adsorption factors of different energy X-ray in each of the minerals.

The obtained data are under calibration so far. We will clarify their 3D structure and discuss about their formation processes. Additionally, we are planning to make their ultrathin sections by focused ion beam fabrication system (FIB) and confirm detailed structures between the tiny component grains with transmitted electron microscope (TEM).

References:

- Abe M. et al. (2011) LPS XLII, Abstract #1638.
- Tsuchiya et al. (2013) GCA 116, 5.

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