A RESEARCH PLAN FOR AGGRIGATE TYPE ITOKAWA PARTICLES.

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Introduction: The Hayabusa spacecraft accomplished touchdowns onto a S-type asteroid Itokawa twice and returned its reentry capsule to the Earth in June 2010 [1]. After it was recovered in the Australian desert and sent back to Japan, it was treated in clean rooms of the extraterrestrial sample curation center (ESCUC) of JAXA and finally returned samples were recovered from the sample catcher, as described in [2]. So far, more than 400 of particles are described initially with SEM-EDS [3]. Among these particles, there exist a type of particles, which are mostly composed of aggregates of small mineral grains (<5 μm). Because the aggregations of the small grains should have occurred on the surface of asteroid Itokawa, clarification of their formation processes should result in understanding of the environment of surface of small bodies in the solar system.

Based on memorandum of understanding (MOU) between JAXA and NASA, 15% of Hayabusa-returned samples are allocated to JAXA. Utilizing this fraction, five aggregate-type particles have been selected for this research.

A plan for analysis scheme of the aggregate type Itokawa particles: We plan to perform synchrotron computed tomography (CT) to obtain 3-D stractural and chemical data for all the assigned particles using Si_3N_4 sample holders [4]. Then we plan to slice three of them with focused ion beam (FIB) system or ultramicrotome (UM) to obtain their transmitted electron microscope (TEM) thin sections. We will observe these sections with TEM to observe grain boundaries of the aggregates in detail to clarify how the grains get together, like sintering and/or fusion process, or existence of intermediate phase to stick grains each other. Rest of sliced particles will be examined with field-emission electron probe micro analyzer (FE-EPMA) to clarify a chemical composition of each grain in aggregates.

We now plan to analyze fracture strengths of the rest two of the particles analyzed by synchrotron CT [e.g. 5]. By understanding physical strength of the grain aggregates, we could expect to estimate their growth rates on the asteroid surface, assuming a micrometeoroid impact rate on it.

We will now start negotiation for a researcher using TEM and one analyzing fracture strength of small particles. Then we will start synchrotron CT analysis in near future, which will be detailed in the symposium.

References: [1] Abe M. et al. (2011) *LPS XLII*: #1638. [2] Yada T. et al. (2013) *MAPS, in press.* [3] Yada T. et al. (2013) *in this symposium*. [4] Uesugi M. et al. (2013) *76th MetSoc.*: #5146. [5] Kuzumaki T. et al. (2012) *Diam.& Relat.Mater.*: 25, 1.