Construction of a method of a sequential petrologic and crystallographic analysis at JAXA for the study of the difference of two sampling points of Hayabusa.

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Introduction: Hayabusa spacecraft retrieved regolith particles from two points on the surface of the asteroid, Itokawa. The regolith particles from the first touch down point were stored to Room B of the sample catcher, and those of second touch down point were stored to Room A. If there are differences between the Itokawa particles of Room A and B, it suggests the heterogeneity of the materials on the surface of Itokawa. The heterogeneity would be a key of the evolution of Itokawa, and we can quantitatively investigate the evolution through the analyses of Itokawa particles. Though the study should require the data of a large number of samples, it is one of the important issues for the study of the Hayabusa-returned samples.

Yada et al. (2012) showed a possible difference of the mineral composition of the Room A and Room B. The particles in Room B is slightly higher plagioclase contents compared to Room A particles in several size bins. Difference of the abundance of the shock melted minerals might be a possible origin of the difference, if it is the actual tendency of the two sampling points,. Melt textures observed in chondrites characterized by several features. Plagioclases (or maskelynites) with tiny blebs are one of the important minerals which characterize the shock melt. We can investigate the difference of two sampling points quantitatively by observing the petrologic and crystallographic features of minerals, such as chemical compositions, shocked textures and dislocation density of the minerals. In this paper, we describe a sequence of the investigation of the crystallographic analysis of the regolith particles of the Itokawa, that is now constructed at the extraterrestrial sample curation center (ESCuC).

Method: The analyzed Itokawa particles will be also possible samples for further detailed investigations of the international announcement of opportunity (A/O). So we should avoid or reduce contaminations through the investigations, especially from the terrestrial atmosphere which contains abundant water vapor, oxygen and noble gas species. In this new procedure of the investigations, we can avoid the atmospheric exposure by developing new sample holders.

The samples were fixed in a SiN membrane holder. With this holder, we can perform XRD installed at ESCuC without exposing the terrestrial atmosphere and any adhesive materials. Through the investigation by XRD and micro-Raman spectroscopy, we can determine the mineral phases and rough crystal directions. It is important that we can also perform Synchrotron Radiation experiments with the holder. Because SEM observations were already done by the Extraterrestrial sample curation team (ESCuTe), chemical composition can be obtained. After those non-destructive observations, further investigations are also possible for some samples. We can extract ultra-thin sections by FIB for the high resolution investigations by TEM/STEM. Currently all procedures except for TEM/STEM observation can be operated at ESCuC without atmospheric exposure. We will include ultramicrotomy in the procedure in future works.

References: [1] Yada et al. 2012. *Meteoritics & Planetary Science* 47:A5245.