Current status of consortium study for silica-containing Hayabusa-returned particle.

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INTRODUCTION: More than 500 particles of the Hayabusa-returned samples from S-type asteroid Itokawa were catalogued by Extraterrestrial Sample Curation Center (ESCuC) in Astromaterials Science Research Group (ASRG) of JAXA, so far [1]. The investigations by preliminary examinations and international AOs provided important insights into the formation and evolution processes of asteroid 25143 Itokawa [e.g. 2-10]. The preliminary examinations revealed that Itokawa particles were equivalent to equilibrated LL chondrites. Furthermore, these particles showed evidences of shock metamorphism and the shock processes they experienced were discussed [2, 8-10].

Some of the Hayabusa-returned samples show unique characteristics of mineralogy, composition, structure, and/or size, therefore it is difficult to allocate such samples for International AOs. In order to obtain maximum scientific results from these particles, consortium studies have been conducted by team of ESCuC [11-13]. In this paper, we report current status of a new consortium study of particle RB-QD04-0069 that contains silica. Because silica forms many polymorphs [e.g. 14], it can be a useful indicator to constrain thermal and shock history of the particle.

SAMPLE AND ANALYSIS FLOWS: RB-QD04-0069 is a particle with a size of 33 μm, which was captured from the first touchdown site on Itokawa. Initial description by FE-SEM-EDS showed that the particle consists of olivine, high-Ca pyroxene, low-Ca pyroxene, plagioclase, and silica. This is the only particle containing silica with other silicate minerals among catalogued Hayabusa-returned samples, so far. Silica is widespread in ordinary chondrites, but its abundance is very low (usually < ~1 vol %) [15]. Therefore, this particle is precious and should be investigated as consortium study.

The particle will be picked up from slide glass in pure nitrogen-filled environment clean chamber in ESCuC by quartz glass probe using manipulator system. Then, the particle will be attached to the top of C fiber in a clean booth at ESCuC for Synchrotron radiation (SR) XRD analysis and SR XCT imaging. The XRD analysis will provide us crystallographic information of silica and other silicate minerals. Moreover, textural information of the particle will be obtained by the SR XCT imaging. After the synchrotron radiation analyses, the particle will be embedded in epoxy resin EPON-812, followed by polishing until the surface of the particle is exposed. Oxygen isotope compositions will be measured by SIMS in order to identify the origin of the particle. Furthermore, FE-EMPA analysis and TEM observations of the particle will help us provide important constraints on formation condition of the particle, in particular its shock and thermal history.

CURRENT STATUS: Rehearsal of attachment to C fiber has been performed at ESCuC of JAXA. The particle will be attached to the top of C fiber using manipulator system with epoxy resin Embed-812, which keep in place 3 hours after mixing in order to increase viscosity. The particle attached to the C fiber will be heated by hotplate at about 1cm above the surface of hot plate, at 130 ºC for 5 minutes, to solidify the epoxy keeping it with manipulator system. After the C fiber with particle is removed from the manipulator system, it will be heated in a constant-temperature bath at 75 ºC for 30 minutes to solidify the epoxy more firmly, and finally will keep in vacuum desiccator.

Quartz glass probe was used for pick-up and handling of Hayabusa-returned particles at ESCuC, therefore, it is necessary to confirm whether the silica in the particle RB-QD04-0069 was the contamination of the probe. For that, SR-XRD and SR-XCT analyses on the synthetic quartz glass probe were performed for a comparison with those of the particle RB-QD04-0069.

SR-XRD and SR-XCT analysis of the particle RB-QD04-0069 will be performed in November. We will present these results in this paper.

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