Present status of preparation for the Ryugu sample curation returned by the Hayabusa2

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Hayabusa2 spacecraft had launched in Dec. 2014 and reached the C-type asteroid Ryugu in June 2018 [1]. It has been observing the asteroid with a series of remote-sensing instruments and plans to perform the first touchdown for sampling at the beginning of this year [1, 2]. It will depart from the asteroid at the end of 2019, and return its re-entry capsule encapsulating Ryugu's surface samples back to the Earth at the end of 2020 [1, 2].

In parallel with the spacecraft operation, JAXA has been preparing for the curation of the samples returned from the asteroid. A new class-1000 clean room for Hayabusa2-returned Ryugu samples was established in Sept. 2017. Installation of newly developed sample-handling clean chamber system (CCs) was accomplished by last Oct. The entire sample-handling system consists of five chambers (CC3-1, CC3-2, CC3-3, CC4-1 and CC4-2).

Because C-type asteroids are likely to be parent bodies of hydrated carbonaceous chondrites [3], volatile components such as water and organic matter are one of essential science target for sample analysis [4]. To return volatile-containing samples without contamination of terrestrial volatiles, a new metal sealing system was developed for the Hayabusa2 sample container [5, 6]. Although the sealing system using double Viton O-rings for the Hayabusa container could not prevent terrestrial air contamination [7], the metal sealing system can keep the air contamination less than 1 Pa for 100 hour in the air [5, 6].

After the recovery of re-entry capsule at the landing point, it will first be transferred to the quick look facility (QLC) nearby there. Following the securing processes to the capsule, the sample container will be extracted, cleaned up and connected to a gas sampling system in a clean booth to extract gaseous volatiles inside the container. After the gaseous volatile recovery from the container, the container will then be delivered to the JAXA's curation facility with being kept in a nitrogen atmosphere during the travel from the QLC to Japan. Then the parts of the container which should not be introduced into the CCs will be removed in the cleanroom. Finally, the sample container will be set to the container opening system and installed into CC3-1.

The container will be opened at the CC3-1 in vacuum condition to take out the sample catcher that encapsulates Ryugu grains. The extracted sample catcher will be transferred to CC3-2. The sample catcher has three chambers for keeping samples collected at different surface locations separately [5, 6], and a lid of the chamber for samples obtained at the first sampling location will be taken apart to pick up a small fraction of grains. The picked-up samples will be kept in CC3-2 for future generations under a vacuum condition. The catcher will be transferred from the CC3-2 to CC3-3 under a vacuum condition, and then CC3-3 will be purged with purified nitrogen. The catcher will be transported to CC4-1 and CC4-2 to take out grains from three chambers of the container. As the initial description called 'phase-1' curation work under purified nitrogen environment in CCs, the grains will be weighed, observed with a stereomicroscope, and examined with visible to near-infrared spectrometers in CC3-3

and CC4-2.

Functional checks of the sample handling system and rehearsals of receiving and handling samples will be initiated in April 2019. The sample handling system will be reconditioned in early 2020 based on feedbacks from the preparation activities to be ready for the sample return in late 2020.

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