JAXA Detailed Description -Variation of surface characteristics of Ryugu returned samples-

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The Ryugu sample brought back by the Hayabusa2 spacecraft in December 2020 weighed ~5.4 g, which is much larger than we expected [1, 2]. After the samples were delivered to JAXA Extraterrestrial Curation Center, individual grains have been picked up and stored into sapphire dish, and analyzed by optical microscope, weighting, FTIR spectroscopy, and MicrOmega hyperspectral imaging [3] for initial description [2]. The obtained data will open in early 2022 for International Announcement of Opportunity (AO) through curatorial Database System for Ryugu Sample [4]. During the ffirst 6 months, we observed 205 individual grains, 100 from chamber A and 105 from chamber C. There are some unique characteristic features on the surface. Here, we propose a morphological classification of these surface features into 4 groups, based on visible characteristics of Ryugu samples. 1/ Dark and fluffy: these features are dominant in Ryugu samples; 2/ Dark and glossy: they are present either on a part or on the entire of grain; 3/ Bright: also present either on a part or on the entire of grain; 4/ White regions: they are observed over 300 μm in size. Those characteristics may be observed alone or in duplicate on a single grain.

In July 2021, 4 grains showing those different features, were allocated as JAXA detailed description (JAXA-DD) (Fig.1). We conduct petrological and mineralogical observation by SEM and XRD to understand the linkage with surface characteristics obtained by the initial description. The purpose of this study is to contribute to the sample selection by researchers at Int'l AO.

FE-SEM/EDS observation was performed using Hitachi SU6600 equipped with slow purge system in order to non-air-exposure transportation from glove box to SEM, on the front surface where the main initial description was made. For two grains A0017 and C0094, where the entire front surface shows unique characteristics, SEM observation was also performed on the back surface. After these observations, we performed a sample chipping under pure N2 atmosphere inside Glove Box. A specially developed tantalum chisel is used for the division. Since tantalum is also used as a bullet when collecting samples on the asteroid, it was selected as materials for the purpose of unifying the potential sources of sample contamination. From the divided sample, we separated small portions showing each of the four characteristics and we performed additional SEM observations. We handled the samples under non-air-exposure environment until the sample division. The small portions are attached to carbon fiber with glue for future XRD analysis using RIGAKU RA-Micro7 HFMR.

In this presentation, we will introduce the variations of Ryugu sample surface characteristics, reflecting variations of their mineralogy and petrography, coordinated with JAXA initial description.

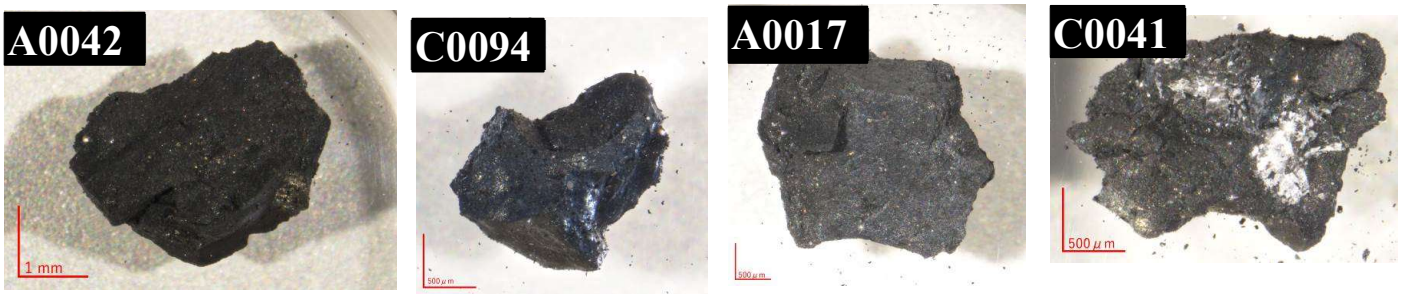

Figure 1. Optical microscopic images of 4 grains allocated to JAXA-DD.

a) A0042 : Dark and fluffy feature is dominant in Ryugu samples. b) C0094: Dark and glossy characteristic is appeared on entire surface. c) A0017: Bright area cover most of the front surface. d) C0041: White region is shown at the right bottom and left top of grain.

References: [1] Tachibana S. et al. (2021) LPS, XXXXXII, Abstract #1289. [2] Yada T. et al. (2021) LPS, XXXXXII, Abstract #2008. [3] Bibring J.-P. et al (2017) Space Sci. Rev. 208, 401-412. [4] Nishimura M. et al. (2021), Astromaterials Data Management in the Era of Sample-Return Missions Community Workshop, Abstract.