

THE CONTAMINATION CONTROL FOR HAYABUSA-RETURNED SAMPLE IN EXTRATERRESTRIAL SAMPLE CURATION CENTER OF JAXA.

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Introduction: Hayabusa spacecraft captured particles at the surface of an asteroid (25143)Itokawa [1]. The samples were stored in the re-entry capsule of Hayabusa, and successfully brought to the Extraterrestrial Sample Curation Center (ESCuC) of JAXA in 2010 [2,3,4]. They were extracted from the capsule and have been preserved in ESCuC [3,4].

Contamination control of extraterrestrial samples is essential matter, and it is important to handle and preserve samples without terrestrial contamination and alteration as possible [5]. So, we developed quartz glass cleaning method to protect the samples from terrestrial contaminations.

Procedure of the cleaning method: The cleaning processes are performed in the clean room of ESCuC. The first step of ultrasonic cleaning is to remove mainly organic impurities. Its solvent is typically 2-propanol. The cleaning is repeated more than twice with 40 kHz frequency band for 20 minutes, changing the solvent each time. The next step is to remove particles and ions. Its solvent is ultrapure water, overflowing from the ultrasonic bath to keep providing fresh water. The cleaning is repeated twice at every frequency of 40, 100 and 1000 kHz bands, for 20 to 30 minutes. For quartz glass plates, acid and alkali treatment is performed after the series of ultrasonic cleanings. They are washed by heated alkali and acid solutions to remove organics, ions and particles, twice respectively with ultrapure water rinse.

Evaluation for the cleaning method: The cleanness of washed quartz glass plates was evaluated with three methods.

1. Concentrations of 32 kind of metal contaminant (B, Na, Mg, Al, K, Ca, Ti, Cr, Mn, Fe, Ni, Co, Cu, Zn, Ga, Sr, Y, Zr, Mo, Pd, Ag, Cd, In, Sn, Ba, La, Hf, Ta, W, Pt, Au and Pb) remained on the plate were evaluated by vapor phase decomposition inductively coupled plasma mass spectrometry (VPD-ICP-MS)[6]. These elemental concentrations on the plates were $1\sim 1000 \times 10^9$ atom/cm² or less than detection limits.
2. Organics on the plates were evaluated by thermal desorption gas chromatograph mass spectrometry (TD-GCMS)[7]. Total amount of the organic carbon on the plates were less than 0.5×10^{-9} g/cm².
3. Particle contaminants on the plates, larger than a few microns, were not observed by microscopes.

References: [1] Fujiwara et al. (2006) *Science* 312, 1330. [2] Abe et al. (2011) *LPS* 42, #1638. [3] Fujimura et al. (2011) *LPS* 42, #1892. [4] Yada et al. (2012) *MAPS* 49, 135. [5] Ishibashi et al. (2013) *JPCU*, PPS24-P18. [6] M.B. Shabani (2012) *Bunseki* 8, 423. [7] Taira et al. (2009) *Cleantechnology* 4, 45.