

Fluorescence imaging of microbe-containing micro-particles that had been shot from a two-stage light-gas gun into an ult

KAWAGUCHI, Yuko^{1*} ; SUGINO, Tomohiro² ; TABATA, Makoto¹ ; OKUDAIRA, Kyoko³ ; IMAI, Eiichi⁴ ; YANO, Hajime¹ ; HASEGAWA, Sunao¹ ; YABUTA, Hikaru⁵ ; KOBAYASHI, Kensei⁶ ; KAWAI, Hideyuki⁷ ; MITA, Hajime⁸ ; HASHIMOTO, Hirofumi¹ ; YOKOBORI, Shin-ichi² ; YAMAGISHI, Akihiko²

¹ISAS/JAXA, ²Tokyo University of Pharmacy and Life Sciences, ³University of Aizu, ⁴Nagaoka University of Technology, ⁵Osaka University, ⁶Yokohama National University, ⁷Chiba University, ⁸Fukuoka Institute of Technology

We previously proposed an experiment (the Tanpopo mission) to capture microbes and organic compounds on the Japan Experimental Module of the International Space Station. An ultra low-density silica aerogel will be exposed to space for one year. After retrieving the aerogel, particle tracks and particles found in it will be visualized by fluorescence microscopy after staining it with a DNA-specific fluorescence dye. In preparation for this study, we simulated particle trapping in the aerogel so that methods could be developed to visualize the particles and their tracks. During the Tanpopo mission, particles that have an orbital velocity of about 8 km/s are expected to collide with the aerogel. To simulate these collisions, we shot *Deinococcus radiodurans*-containing Lucentite particles into an aerogel from a two-stage light-gas gun (acceleration 4.2 km/s). The shapes of the captured particles and their tracks and entrance holes were recorded with a microscope/camera system for further analysis. The size distribution of the captured particles was smaller than the original distribution, suggesting that the particles had fragmented. We were able to distinguish between microbial DNA and inorganic compounds after staining the aerogel with the DNA-specific fluorescence dye SYBR green I as the fluorescence of the stained DNA and the autofluorescence of the inorganic particles decay at different rates. The developed methods are suitable to determine if microbes exist at the International Space Station altitude.

Keywords: Aerogel, Space experiment, Hypervelocity impact experiment, DNA-specific fluorescence dye.

Keywords: Aerogel, Space experiment, Hypervelocity impact experiment, DNA-specific fluorescence dye