Micro FTIR and Raman characterization of organic particles captured by aerogel using two-stage light gas gun

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TANPOPO which is a plan to capture cosmic dust grains on International Space Station (ISS) is adopted as one of the second stage science plans of exposure parts of ISS. One of the key issues is how to collect organic particles with velocities over several km/sec and how to analyze them. A series of simulation experiments for capturing organic particles in aerogel has been conducted by shooting samples to aerogel using a two-stage light gas gun. The shot samples have been analyzed by various methods. We analyzed here shot samples by Fourier transform infrared micro-spectroscopy (micro FTIR) and Raman micro-spectroscopoy.

Amino acids, microorganisms, these mixed with montmorillonite and silica gel, and Murchison meteorite were used as simulated organic particles. They were shot to aerogel blocks at around 4km/sec using a two-stage light gas gun. Then the samples are picked up from aerogel, pressed on aluminum plates, and measured by micro FTIR. Aerogel mainly composed of silica contains a small amount of organic matter. Therefore infrared absorption spectra of organic particles captured in aerogel were compared with the same samples without it. These results suggest that organic matter mixed with minerals survived better than organics only.

Raman spectra of Murchison meteorite particles captured in aerogel were measured in-situ with the grains still in the aerogel by a Raman micro-spectrometer. The spectra of captured Murchison in aerogel showed G band (1580 cm-1) and D band (1375 cm-1) due to graphite-like macromolecular organics. Their peak positions, widths (and their ratios) and intensity ratios of the captured Murchison was not different from the original Murchison and in the value ranges for meteorites and Stardust samples. These Raman parameters of Murchison particles do not vary significantly on different locations on the capture tracks in the aerogel. Therefore, effects of thermal metamorphism upon capturing in the aerogel are not considered to be significant for graphite-like macromolecular organics.