Development of 3-D image analyses for impact tracks by cosmic dust in aerogel and it's application using X-ray CT.

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Meteorites and cosmic dusts are samples for

investigating the origin and evolution of primitive materials in the early solar system. However, we cannot decide their parent bodies definitely. Moreover, they have experienced some metamorphism more or less during their atmospheric entry or on the Earth. Therefore, it is most desirable to go to the space and collect samples from their parent bodies directly (sample return).

For this purpose, Stardust spacecraft of NASA launched on 1993, captured cosmic dusts from Comet Wild2, and returened the samples to the Earth in January of 2006. For interplanetary dust, European Retrievable Carrier (EuReCa) spacecraft was succeed in capturing particles in the low earth orbit during 1992-93. In these missions, silica aerogel was used as collectors for intact capture of the microparticles.

However, the particles captured in aerogel were disaggregated into many grains especially in Stardust, and there were a variety of morphologies of the hypervelosity impact tracks, suggesting a variety of the cosmic dust.

We tried to estimate physics of the capture in silica aerogel based on three-dimensional structures of impact tracks obtained from X-ray computed tomography (CT). X-ray CT measurement on three impact tracks onbord EuReCa spacecraft has been carried out, and 3-D distribution of condensed (melted and/or compressed) aerogel and fragments of impactors, which could not be obtained from optical microscopy, have been recognized [1]. In this study, we succeeded in obtaining details of 3-D track structures quantitatively and established method for impact track analysis. We could also apply this method to primary examination of Stardust samples.

Here, we will present the method of 3-D image analyses for the impact tracks and it's application to EuReCa and Stardust samples. Results for the Stardust samples in combination with XRF will be reported separately [2].

[1] Tsuchiyama et al. (2005) Meteor. Plant. Sci., 40, Suppl. A158.
[2] Tsuchiyama et al. (2007) this meeting.