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Mass Ratio of Crystalline to Amorphous Silicates for the Ejecta Dust of Comet 9P/Tempel 1 Induced by Deep Impact

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We carried out mid-infrared observations (multi-band imaging and N-band spectroscopy) of the Deep Impact (DI) collision with a Jupiter family comet (JFC) 9P/Tempel 1 using the Cooled Mid-Infrared Camera and Spectrometer (COMICS) on the 8.2 m Subaru Telescope. Main results derived from the multi-band imaging observations together with the spectroscopy are reported in [1], and will be presented and discussed by Sugite et al. in this session. We will concentrate on the spectroscopic data and discuss about the results of the analysis by a thermal emission model of the cometary dust in this presentation. The N-band spectrum (8-13 micron; R$\sim$250) of the dust ejecta from the comet nucleus 3.5 hours after the DI event shows a strong crystalline olivine feature. We also made spectroscopic observations 24 hours before and 28 hours after the impact. These spectra have no evident silicate feature in 10 micron region. We present several spectra at the different positions from the comet nucleus, and report the preliminary results of our fitting analysis using the thermal emission model of cometary dust grains. The method used here is the same as our previous one [2], and similar to the techniques used by previous authors [eg.3]. In this thermal emission model, the grain size distribution, porosity, and five grain components (amorphous olivine and pyroxene, amorphous carbon, and crystalline olivine and pyroxene) are taken into account. Since it is also expected that the size distribution of ejecta dust excavated by the DI collision is different from the ordinary coma dust, we examine the observed spectra with several size distributions (Hanner, power-law, and lognormal size distribution, etc). As for the sub-micron grains in the ejecta by the DI collision, we obtain the crystalline-to-amorphous mass ratio (CAR) of silicate larger than 4. The CAR for this subsurface dust of 9P/Tempel 1 is much larger than the dust in the coma of other JFC, such as 78P/Gehrels 2, but similar to Oort cloud comets, such as Hale-Bopp. [1] Sugita et al., Science 310, 274, 2005[2] Ootsubo et al., Planetary and Space Science, submitted[3] Harker et al., ApJ 580, 579, 2002