DENSITY, POROSITY, MINERALOGY, AND INTERNAL STRUCTURE OF COSMIC DUST AND ALTERATION OF ITS PROPERTIES DURING HIGH VELOCITY ATMOSPHERIC ENTRY.

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Introduction: X-ray microtomography (XMT), X-ray diffraction (XRD) and magnetic hysteresis measurements were used to determine micrometeorite internal structure, mineralogy, crystallography, and physical properties at ~µm resolution [1]. The study samples include unmelted, partially melted (scoriaceous) and completely melted (cosmic spherules) micrometeorites. This variety not only allows comparison of the mineralogy and porosity of these three micrometeorite types, but also reveals changes in meteoroid properties during atmospheric entry at various velocities.

Results: At low entry velocities, meteoroids do not melt, and their physical properties do not change. The porosity of unmelted micrometeorites varies considerably (0-12%) with one friable example having porosity around 50%. At higher velocities, the range of meteoroid porosity narrows, but average porosity increases (to 16-27%) due to volatile evaporation and partial melting (scoriaceous phase). Metal distribution seems to be mostly unaffected at this stage. At even higher entry velocities, complete melting follows the scoriaceous phase. Complete melting is accompanied by metal oxidation and redistribution, loss of porosity ($1 \pm 1\%$), and narrowing of the bulk (3.2 ± 0.5 g/cm^3) and grain (3.3 ± 0.5 g/cm^3) density range. Melted cosmic spherules with a barred olivine structure show an oriented crystallographic structure, whereas other subtypes do not.

References: [1] Kohout T. et al. 2014. *Meteoritics & Planetary Science* doi: 10.1111/maps.12325.