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Mineralogical and isotope characteristics of chondrules in short-period comet Wild2.

Tomoki Nakamura[1*], Takaaki Noguchi[2], Akira Tsuchiyama[3], Takaaki Ushikubo[4], Noriko Kita[4], John Valley[4], Naoto Takahata[5], Wataru Fujiya[5], Yuji Sano[5], Mike Zolensky[6], Kentaro Uesugi[7], Tsukasa Nakano[8]

[1]Kyushu University, [2]Ibaraki University, [3]Osaka University, [4]Wisconsin University, [5]Tokyo University, [6]NASA/JSC, [7]SPring-8, [8]AIST

High-temperature objects such as CAIs [1] and chondrules [2] have been found in short-period comet Wild2. The most plausible explanation for the presence of chondrules in the outer solar nebula is formation of chondrules in the inner solar nebula and transportation of chondrules from inner to outer solar nebula. So far, we found six stardust particles that show mineralogical and textural features characteristic of chondrules in asteroids. All particles exhibit porphyritic or poikilitic texture, which indicates that they experienced partial melting during heating of chondrule formation. Five out of six particles were analyzed for oxygen isotope ratios and the results show that the five chondrule-like particles have oxygen compositions that distribute between CCAM and Young & Russell [3] line similar to carbonaceous chondrite chondrules. Carbonaceous chondrites are located in the middle to outer asteroid belt and our results indicate that chondrules in the short-period comet are very similar to chondrules at outer asteroid belt, but are not similar to those at inner asteroid belt.

Compared to chondrules in carbonaceous chondrites, cometary chondrules have slightly different characteristics: (1) small grain size of olivine and pyroxene, (2) very heterogeneous oxygen composition of olivine, (3) the presence of MnO-rich olivine and low-Ca pyroxene, and (4) the presence of Na-rich plagioclase. These characteristics may indicate that cometary chondrules experienced a lower degree of heating, or fewer times of heating than chondrules in carbonaceous chondrites. Nano-sims measurement is underway on 3 x 5 micron size plagioclase crystals in a cometary chondrule in order to determine formation age of the chondrule using Al-Mg systematics.

1. Zolensky et al. (2006) Science 314, 1735-1739. 2. Nakamura et al. (2008) Science 321, 1664-16 67. 3. Young et al. (1998) Science 282, 452-455.

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