# Presolar Silicate Grains in Enstatite Chondrites

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Introduction: Primitive meteorites contain presolar grains that predate the formation of our solar system. Recently presolar silicate grains were identified in IDPs[1] and in primitive carbonaceous and ordinary chondrites[2-6]. In enstatite chondrites, presolar carbonaceous and oxide grains have been reported[e.g.7-9], but no presolar silicate grains have been identified. Here we report the first finding of presolar silicates from in three primitive enstatite(EH3) chondrites.

Experimental: The samples used are polished thin section of Yamato(Y)-691, Allan Hills(ALH)A81189, and Sahara(SAH) 97072. Mineralogical and petrographical characterization of matrices was conducted using a scanning electron microscope (SEM)(JEOL JSM-5310LV) equipped with energy dispersive X-ray spectrometer (EDS)(Oxford LINK ISIS) and field emission SEM(JEOL JSM-7000F) equipped with EDS(Oxford INCA Energy). Presolar grains were surveyed by isotopography using an isotope microscope system(Cameca ims-1270 + SCAPS[10]); originally installed in TiTech and now in Hokkaido Univ.(Hokudai).

Results: The total analyzed areas of oxygen isotopographs are about 61,000, 58,000 and 30,000 micrometer squares for Y-691, ALHA81189 and SAH 97072. 3 and 9 presolar silicates were identified for Y-691 and ALHA81189, respectively, whereas no presolar silicates were identified for SAH 97072. Presolar carbonaceous grains were also identified by carbon isotopographs: 10 grains from areas of about 63,000 micrometer squares for Y-691; 6 from about 61,000 for ALHA81189; and 2 from about 32,000 for SAH 97072. Matrix-normalized abundances of presolar silicate grains were calculated to be about 49, 155 and under 33grains/mm2 corresponding to about 4, 14 and under 3ppm for Y-691, ALHA81189 and SAH 97072, resprctively, assuming the mean grain size to be 0.3 micrometer in diameter. In the same calculation method, presolar carbonaceous grains were calculated to be about 159, 98 and 62 grains/mm2 corresponding to about 14, 9 and 6ppm for Y-691, ALHA81189 and SAH 97072, respectively.

Disscussion: The carbonaceous presolar grains are roughly equally distributed in the three EH3 chondrites in this study. The smaller abundance in SAH 97072 may be due to decomposition of the presolar carbonaceous grains by thermal metamorphism and/or aqueous alteration in the parent body. The abundance of presolar silicates is the highest in ALHA81189 and continues to Y-691, SAH 97072. The lowest abundance for SAH 97072 is the same case of carbonaceous grains. These results support that metamorphic degree is highest in SAH 97072 among the three EH3 chondrites. The abundance of presolar silicates is much smaller in EH3 chondrites than in primitive carbonaceous chondrites[5]. The EH3 chondrites have undergone some parent body metamorphism. The small abundance in EH3 chondrites suggests that parts of the preosolar silicate grains of EH3 chondrites have been decomposed by the mild thermal metamorphism. Other possibilities are that the EH3-matrix materials have been affected thermally during chondrule formation or dilluted to a greater extent by fragmentation of chodrules. The abundance of presolar silicate grains (14ppm) of ALHA81189 is probably a minimum estimate of the original abundance for EH3 chondrite formation area in the solar nebula. The oxygen isotopic compositions of presolar silicates show that the most grains (about 80%) belong to group 1. The rest grains belong to group 4[11].

References: [1]Messenger et al.(2003) Science300, 105-108 [2]Nguyen and Zinner(2004) Science303, 1496-1499. [3]Nagashima et al.(2004) Nature428, 921-924. [4]Mostefaoui and Hoppe(2004) ApJ613, L149-L152. [5]Kobayashi et al.(2005) Antarct.Meteor.XXIX, 30-31. [6]Tonotani et al.(2006) LPSXXXVII, #1539. [7]Huss and Lewis(1995) GCA59, 115-160. [8]Besmehn et al.(2001) MAPS36, A20. [9]Lin et al.(2002) ApJ575, 257-263. [10]Yurimoto et al.(2003) Appl.Surf.Sci.203-204, 793. [11]Nittler et al.(1997) ApJ483, 475-495.