J235-005 **Room: Exibition hall 7 sub** **Time: May 17 14:45-15:00**

Petrology and oxygen isotopic composition of a compound CAI from Allende meteorite

Shigeyuki Wakaki[1]; Shoichi Itoh[1]; Tsuyoshi Tanaka[2]; Hisayoshi Yurimoto[1]

[1] Natural History Sci., Hokudai; [2] Earth and Environmental Sci., Nagoya Univ.

Ca, Al- rich inclusions (CAIs) and Mg, Si-rich chondrules are main components of carbonaceous chondrites. CAIs and chondrules differ in their chemical and isotopic compositions. Absolute dating of CAIs and chondrules showed a 2 Ma difference between the formation ages of these two substances (Amelin et al., 2002). CAIs and chondrules are believed to be formed separately by different heating processes in the solar nebula (Wood, 1996). However, recent observations of the compound CAI-chondrule objects (Itoh and Yurimoto, 2003; Krot et al., 2005) suggest that CAIs and chondrules are contemporaneously formed by the same heating process or that CAIs and chondrules are re-melted together after mixing of these two objects. Although they are few such studies, thermal history of compound objects are expected to give a constraint on the relationship between CAI and chondrule forming processes. We report petrology and oxygen isotopic compositions of a compound CAI (CAI 025) from Allende (CV3). Oxygen isotope analyses were performed in situ by SIMS (Cameca ims-1270) using Cs+ primary ion beam focused to 2~10 micron spot. Standards are matrix-matched to the sample minerals. Repeatability of the standard analysis was about 2 per mil (1SD) on both d17O and d18O.

CAI 025 consists of two textually and chemically distinct portions: Al-rich interior and Si-rich igneous rim. The interior portion contains framboidal spinel and subhedral olivine poikilitically enclosed in anorthite. Some olivine grains are overgrown by Al-bearing low-Ca pyroxene. Micron sized Fe-Ni sulfide grains occur on spinel grain surfaces. Major element chemistry of the interior portion is consistent with the texturally inferred crystallizing sequence: spinel, olivine, low-Ca pyroxene and anorthite. Chemical composition of the interior portion is Si-rich compared to typical CAIs and falls in the range of Al-rich chondrules. The rim portions are texturally similar to chondrules that consists of olivine, low-Ca pyroxene, plagioclase and FeS. Chemical compositions of the rim portion are similar to that of the magnesian chondrules.

Oxygen isotopic compositions of all the constituent minerals of CAI 025 plot along the CCAM line on oxygen three-isotope diagram. Spinel is enriched in O-16 by ~40 per mil and clustered into three groups with distinguishable isotopic compositions. Olivine and low-Ca pyroxene in both the interior portion and the rim portion have indistinguishable oxygen isotopic compositions with D17O range from -12.6 to -2.9. Anorthite in the inner portion is O-16 depleted (D17O = -2.7 ~0.8).

The oxygen isotopic compositions of CAI 025 minerals are correlated with the inferred crystallizing sequence. Subhedral nature of the interior spinels and olivines indicates that these phases are residues of incomplete melting. Small oxygen self-diffusion coefficient in spinel (Ryerson and McKeegan, 1994) indicates that the oxygen isotopic composition of spinel will not change significantly by secondary diffusion that may took place during the incomplete melting. Thus, the range in the oxygen isotopic composition of spinel is reflecting the differences in oxygen isotopic composition of the liquid when each spinel grain had crystallized. Oxygen isotopic compositions of olivine and low-Ca pyroxene indicate that both interior portion and rim portion was melted under relatively O-16 poor condition. These observations indicate that incomplete melting was repeated several times under different oxygen isotopic compositions. Olivine and low-Ca pyroxene does not crystallize from a melt of CAI composition. Thus, mixing of Si-rich chondrule-like component to the precursor CAI before the formation of olivine is suggested. Occurrence of Fe-Ni sulfide grains in the interior part supports this view. The above observations suggest that CAI 025 was formed by repeated incomplete melting of a CAI precursor with the presence of chondrule-like material under O-16 poor environment.