CHARACTERIZATION OF PYROXENE HIGHLY ENRICHED IN CA-TSCHERMAK COMPONENT IN THE CH CHONDRITE ALH85085.

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Introduction: Aluminian diopside is commonly encountered in refractory inclusions in many carbonaceous chondrites. Especially it often contains >40 wt.% Al_2O_3, showing extreme enrichment in hypothetical Ca-tschermak component (CaTs) [1-5]. Although such pyroxene is mineralogically significant, it was not subjected to further detailed characterization because of its tiny grain size. Here we report the important mineralogical features of such pyroxene in ALH85085 (CH) previously documented by Kimura et al. [1], by using EPMA, laser micro Raman and electron back-scatter diffraction (EBDS).

Petrography and mineral chemistry: ALH85085 contains abundant refractory inclusions [1]. A spherical inclusion (#186), ~15 μm in size, consists of grossite in its center and surrounding pyroxene [1]. The pyroxene contains 28.8-29.9 % SiO_2, 40.3-42.4 Al_2O_3, 1.0-1.2 FeO, 1.4-2.0 MgO and 25.1-26.2 CaO. The chemical formula is $Ca_{1.01}Mg_{0.09}Fe_{0.03}Al_{0.88}(Al_{0.92}Si_{1.08})O_6$ in average, which indicates 88% CaTs component. A small area of this pyroxene contains 8.7-10.3% TiO_2.

Identification of the pyroxene: We identified the exact nature of this pyroxene by Raman and EBSD. It always shows Raman peaks at 959, 675, 369 and 334 cm^{-1}, consistent with those of pure CaTs [6]. However, these bands are inconsistent with those of hexagonal $CaAl_2SiO_6$ phase first synthesized by [7]. The EBSD patterns of this pyroxene well agree with those of diopside and pure CaTs.

Discussion: From the results obtained by EPMA, Raman and EBSD, we unambiguously exclude the possibility that this is the hexagonal $CaAl_2SiO_6$ phase, or other Ca-Al-silicate and fine-grained breakdown product of pyroxene. The pyroxene studied here has CaTs component much higher than 50 mol.%. Therefore, our study identifies for the first time such phase as CaTs-pyroxene.

CaTs is one of the most important hypothetical components of pyroxene. Here we suggest that this component is no more hypothetical, but a really existing natural mineral. However, CaTs is only stable under high-pressure conditions [8]. No obvious evidence for impact in this inclusion and ALH85085 may exclude the crystallization under high-pressure conditions. Alternatively, we suggest the metastable crystallization of this pyroxene from liquid under low nebular pressure condition [1-3].

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