Forsterite from Kaba Meteorite and its Implication for Astromineralogy

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Kaba is the most primitive and the least metamorphosed CV chondrite (Keller and Buseck 1990, Krot et al. 1998), which gives its unique nature compared to other carbonaceous chondrites. This meteorite is, therefore, of great interest to us because it will: (1) give us a better understanding of the effects of parent body processing on the mineralogy of CVs and allow comparison of these effects with other meteorite groups, (2) help in determining mineralogy of IDPs, (3) provide us better understanding of the evolution of organic matter in solar system (Gucsik et al. 2013-and references therein). Moreover, study of forsterite ($Mg_2 SiO_4$-the magnesium rich end member of the olivine) content of Kaba meteorite can aid to understand the crystallization processes in planetary nebula, for instance. Therefore, the purpose of this short manuscript is to provide an overview of forsterite from the Kaba meteorite and its application to Astromineralogy.

According to Gucsik et al (2013-and references therein), from the eighties, several researchers studied the samples from the Kaba meteorite on the subjects of the matrix olivine. Hua et al. (2005) indentified fayalite, and later fayalitic halos in forsterite. Based on O-isotopic compositions of magnetite and olivine, the fayalite in the Kaba meteorite might be formed by replacement of pre-existing magnetite and silica. Six types of the chondrules (chondrule with refractory materials; composite chondrule; olivine-pyroxene-spinel chondrule; forsterite-pyroxene chondrule; magnetite-metal chondrule, oxide-sulfide chondrule). By determination of $^{13}C/^{12}C$ ratios with (d, p) nuclear reactions, variation of carbon content of glass inclusions in olivines ranging from 250 to 2090 ppm, and suggested that glass inclusions in olivines may behaved as closed system, with respect to carbon. Magnetite, maghemite, troilite, fayalite and pentlandite are the iron containing components of the Kaba meteorite. According to Hua et al (2005), oxygen, silicon and Mn-Cr isotopes in fayalite from two petrographic settings (big fayalite lath enbedded in the matrix and small fayalite-magnetite-sulfide assemblages within olivine chondrules) indicate that fayalite in both settings formed about 9.7 Ma after the formation of CAIs, and fayalite-magnetite-troilite assemblages formed by aqueous alteration of the meteorite parent body, whereas big fayalite laths did not form in situ.

At low temperature, we can detect narrow and faint luminescence emissions of forsterite as component of nebula and comet dust (Simonia et al. 2006; Simonia 2007; 2011). Potential future studies might comprised also the following directions: a) spectroscopic investigations of blue excess of planetary nebula; b) photometric investigations of blue reflection nebula illuminated by late spectral type stars. 420-550 nm part of forsterite luminescence spectra must be used in time of mentioned investigations as comparative lab data. Taking in to account interests of astromineralogy it will be reasonable to create an atlas of luminescence spectra of forsterite micrograins and other silicate minerals from Kaba and other meteorites. Such database might become an effective tool for determination of chemical-mineralogical composition of cosmic dust.

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