

LETTER

Tistarite, Ti_2O_3 , a new refractory mineral from the Allende meteorite

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ABSTRACT

Tistarite, ideally Ti_2O_3 , is a new member of the corundum-hematite group. It is found as one subhedral crystal in a cluster of micrometer-sized refractory grains along with khamrabaevite (TiC), rutile, and corundum crystals within a chondrule from the Allende meteorite. The mean chemical composition determined by electron microprobe analysis is (wt%) Ti_2O_3 94.94, MgO 2.06, Al_2O_3 1.50, ZrO_2 0.44, FeO 0.24, CaO 0.10, Cr_2O_3 0.06, sum 99.34. The empirical formula calculated on the basis of 3 O atoms is $(\text{Ti}_{1.90}^{3+}\text{Mg}_{0.07}\text{Al}_{0.04}\text{Zr}_{0.01})_{\Sigma 2.02}\text{O}_3$. Tistarite is rhombohedral, $R\bar{3}c$; $a = 5.158 \text{ \AA}$, $c = 13.611 \text{ \AA}$, $V = 313.61 \text{ \AA}^3$, and $Z = 6$. Its electron back-scatter diffraction pattern matches that of synthetic Ti_2O_3 with the $R\bar{3}c$ structure. The strongest calculated X-ray powder diffraction lines from the synthetic Ti_2O_3 data are [d spacing in \AA (I) hkl]: 3.734 (84) (012), 2.707 (88) (104), 2.579 (90) (110), 2.242 (38) (113), 1.867 (33) (024), 1.703 (100) (116), 1.512 (28) (214), 1.489 (46) (300), 1.121 (20) (226), 0.896 (25) (416). The mineral is named after the composition “Ti” and the word “star,” implying that this new refractory mineral is among the first solids formed in the solar system.

Keywords: Tistarite, Ti_2O_3 , new refractory mineral, titanium oxide, Allende meteorite