

Zolenskyite, FeCr₂S₄, a new sulfide mineral from the Indarch meteorite

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ABSTRACT

Zolenskyite (IMA 2020-070), FeCr₂S₄, is a new sulfide mineral that occurs within troilite, with clinoenstatite and tridymite, in the matrix of the Indarch meteorite, an EH4 enstatite chondrite. The mean chemical composition of zolenskyite determined by electron probe microanalysis, is (wt%) S 43.85, Cr 35.53, Fe 18.94, Mn 0.68, Ca 0.13, total 99.13, yielding an empirical formula of Fe_{0.99}Mn_{0.04}Ca_{0.01}Cr_{1.99}S_{3.98}. The ideal formula is FeCr₂S₄. Electron backscatter diffraction shows that zolenskyite has the C2/m CrNb₂Se₄-Cr₃S₄-type structure of synthetic FeCr₂S₄, which has $a = 12.84(1)$ Å, $b = 3.44(1)$ Å, $c = 5.94(1)$ Å, $\beta = 117(1)^\circ$, $V = 234(6)$ Å³, and $Z = 2$. The calculated density using the measured composition is 4.09 g/cm³. Zolenskyite is a monoclinic polymorph of daubréelite. It may be a high-pressure phase, formed from daubréelite at high pressures (several gigapascals) and moderate temperatures in highly shocked regions of the EH parent asteroid before becoming incorporated into Indarch via impact mixing. Zolenskyite survived moderate annealing of the Indarch whole-rock. The new mineral is named in honor of Michael E. Zolensky, an esteemed cosmochemist and mineralogist at NASA's Johnson Space Center, for his contributions to research on extraterrestrial materials, including enstatite chondrites.

Keywords: Zolenskyite, FeCr₂S₄, new mineral, sulfide, Indarch meteorite, enstatite chondrite