

**Crystal Data:** Tetragonal. *Point Group:*  $\bar{4}2m$ . Rarely as crystals, to 6 cm, with a pseudo-octahedral habit due to twinning; also massive, granular, and disseminated. *Twinning:* As penetration twins on {102} and with [112] as twin axis and {112} as composition plane. Polysynthetic lamellae seen in polished section.

**Physical Properties:** *Cleavage:* Indistinct on {110} and {001}. *Fracture:* Uneven. Hardness = 4 VHN = 216–265 (25 g load). D(meas.) = 4.3–4.5 D(calc.) = 4.490

**Optical Properties:** Opaque. *Color:* Steel-gray to iron-black, may tarnish blue; in polished section gray with olive-green tinge. *Streak:* Blackish. *Luster:* Metallic. *Pleochroism:* Indistinct in air, distinct in oil. *Anisotropism:* Distinct; violet and slate-green.

R<sub>1</sub>–R<sub>2</sub>: (400) 21.4–22.2, (420) 22.1–23.4, (440) 23.5–24.7, (460) 24.9–26.0, (480) 26.2–27.0, (500) 27.1–27.8, (520) 27.7–28.3, (540) 27.8–28.4, (560) 27.6–28.3, (580) 27.3–28.0, (600) 27.0–27.6, (620) 26.7–27.3, (640) 26.6–27.1, (660) 26.5–27.0, (680) 26.5–27.0, (700) 26.7–27.1

**Cell Data:** *Space Group:*  $I\bar{4}2m$ . *a* = 5.4432(11) *c* = 10.7299(51) *Z* = 2

**X-ray Powder Pattern:** Synthetic.

3.11 (100), 1.908 (80), 1.640 (60), 1.623 (60), 2.427 (50), 1.784 (50), 1.240 (50)

Chemistry:	(1)	(2)	(3)	(1)	(2)	(3)	
Cu	29.24	29.6	29.58	Sn	27.14	27.7	27.61
Fe	13.95	10.8	12.99	In		0.03	
Zn	0.08	2.2		S	28.88	29.7	29.82
Cd		0.11		insol.	0.51		
				Total	99.80	100.1	100.00

(1) Chocaya, Bolivia; corresponds to Cu<sub>2.04</sub>Fe<sub>1.11</sub>Sn<sub>1.02</sub>S<sub>4.00</sub>. (2) Oruro, Bolivia; by electron microprobe, corresponding to Cu<sub>2.01</sub>(Fe<sub>0.84</sub>Zn<sub>0.14</sub>)<sub>Σ=0.98</sub>Sn<sub>1.01</sub>S<sub>4.00</sub>. (3) Cu<sub>2</sub>FeSnS<sub>4</sub>.

**Polymorphism & Series:** Dimorphous with ferrokesterite.

**Mineral Group:** Stannite group.

**Occurrence:** In tin-bearing vein deposits of hydrothermal origin.

**Association:** Chalcopyrite, sphalerite, tetrahedrite, arsenopyrite, pyrite, cassiterite, wolframite.

**Distribution:** In Cornwall, England, from Wheal Rock, near St. Agnes [TL], and at a number of other mines, where it may constitute an ore mineral. In the Czech Republic, from Cínovec (Zinnwald). In Australia, at Broken Hill, New South Wales, and from Zeehan, Tasmania. In Bolivia, in the Itos and San José mines, Oruro; at Llallagua, Chocaya, and Cerro Rico, Potosí; and from Uncia. In the USA, at the Peerless and Etta mines, near Keystone, Pennington Co., South Dakota. From the Brunswick tin mines, 56 km southwest of Fredericton, New Brunswick, Canada. As large crystals from the Yaogangxian mine, 45 km northeast of Yizhang, Hunan Province, China. Noted in small amounts from a number of other localities world-wide.

**Name:** From the Latin *stannum*, *tin*.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 224–226. (2) Kissin, S.A. and D.R. Owens (1979) New data on stannite and related tin sulfide minerals. *Can. Mineral.*, 17, 125–135. (3) Bonazzi, P., L. Bindi, G.P. Bernardini, and S. Menchetti (2003) A model for the mechanism of incorporation of Cu, Fe and Zn in the stannite-kësterite series, Cu<sub>2</sub>FeSnS<sub>4</sub>–Cu<sub>2</sub>ZnSnS<sub>4</sub>. *Can. Mineral.*, 41, 639–649. (4) Berry, L.G. and R.M. Thompson (1962) X-ray powder data for the ore minerals. *Geol. Soc. Amer. Mem.* 85, 51–52. (5) Ramdohr, P. (1969) The ore minerals and their intergrowths, (3rd edition), 542–553. (6) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 531.

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