Chalcopyrite $CuFeS_2$

Crystal Data: Tetragonal. *Point Group:* $\bar{4}2m$. Equant, tetrahedral-shaped crystals, may be modified by scalenohedral faces, to as large as 10 cm. Sphenoidal faces {112} typically large, dull in luster and striated ‖ [$1\bar{1}0$]; {$\bar{1}12$} faces are small and bright. Commonly massive, compact; can be botryoidal. *Twinning:* Twin plane {112}, composition surface commonly {112}; twin plane {012}; also by rotation about [001] with composition plane {110}, producing penetration twins.

Physical Properties: *Cleavage:* Poor on {011} and {111}. Hardness = 3.5–4
VHN = 187–203 (basal section); 181–192 (vertical section) (100 g load). D(meas.) = 4.1–4.3
D(calc.) = 4.283

Optical Properties: Opaque. *Color:* Brass-yellow, may be tarnished and iridescent.
Streak: Greenish black. *Luster:* Metallic. *Anisotropism:* Weak.
R_1–R_2: (400) 16.0–17.3, (420) 20.0–21.3, (440) 24.8–26.1, (460) 30.2–31.4, (480) 34.9–35.9, (500) 38.9–39.9, (520) 41.9–42.7, (540) 44.0–44.9, (560) 45.4–46.4, (580) 46.6–47.6, (600) 47.1–48.3, (620) 47.5–4.86, (640) 47.6–48.7, (660) 47.6–48.7, (680) 47.6–48.6, (700) 47.6–48.6

Cell Data: *Space Group:* $I\bar{4}2d$. $a = 5.281$ $c = 10.401$ Z = 4

X-ray Powder Pattern: Merkur mine, Ems, Hesse, Germany.
3.038 (100), 1.8570 (35), 1.5927 (27), 1.8697 (22), 1.5753 (14), 2.644 (5), 1.2025 (5)

Chemistry:

	(1)	(2)
Cu	35.03	34.63
Fe	31.00	30.43
S	34.96	34.94
Total	100.99	100.00

(1) Western mines, Vancouver Island, British Columbia, Canada; by electron microprobe, leading to $Cu_{1.01}Fe_{1.01}S_{2.00}$. (2) $CuFeS_2$.

Polymorphism & Series: Forms a series with eskebornite.

Mineral Group: Chalcopyrite group.

Occurrence: A primary mineral in hydrothermal veins, stockworks, disseminations, and massive replacements; an exsolution product in mafic igneous rocks; of sedimentary origin controlled by redox conditions.

Association: Sphalerite, galena, tetrahedrite, pyrite, many copper sulfides.

Distribution: A very common copper mineral, so only a few outstanding localities can be mentioned. In the USA an important ore mineral at many of the copper mines of Arizona, as at Bisbee, Cochise Co.; large crystals from the Groundhog mine, Vanadium, Grant Co., New Mexico; in crystals from New York, at the Rossie lead mines, St. Lawrence Co.; at French Creek, Chester Co., Pennsylvania; in Missouri, at Joplin, Jasper Co. From Cananea, Sonora, Mexico. At Huaron, Peru. In Canada, in the Rouyn district, Quebec, at the Noranda mine; from Ontario, in the Kidd Creek mine, near Timmins, and at Sudbury. In Slovakia, at Baňská Štiavnica (Schemnitz). In the Czech Republic, at Horní Slavkov (Schlaggenwald). From Freiberg, Saxony; Dillenburg, Hesse; in the Georg mine, near Horhausen, Westerwald; and a number of mines in North Rhine-Westphalia, Germany. At Vinsknoes, Karmoen, Norway. From the Ani and Arakawa mines, Akita Prefecture, Japan. Large crystals in the Nababiep mine, Cape Province, South Africa.

Name: From the Greek for *brass* and *pyrite*.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 219–224. (2) Hall, S.R. and J.M. Stewart (1973) The crystal structure refinement of chalcopyrite, $CuFeS_2$. Acta Cryst., 29, 579–585. (3) (1985) NBS Mono. 25, 21, 69. (4) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 84.