

Crystal Data: Tetragonal. *Point Group:* $4/m\ 2/m\ 2/m$. Uncommon in crystals, prismatic || [001], long to short, square cross-section, with fibrous texture, to 8 cm; columnar, reniform, concretionary, dendritic, granular to powdery massive. *Twining:* Repeated on {031}, {032}, rare; may be polysynthetic.

Physical Properties: *Cleavage:* {110}, perfect. *Fracture:* Uneven. Hardness = 6–6.5, to 2 when massive. $D(\text{meas.}) = 5.06(2)$ $D(\text{calc.}) = [5.19]$

Optical Properties: Opaque. *Color:* Light steel-gray, iron-gray to iron-black, may have a bluish cast when massive; in reflected light, white with creamy yellow tint. *Streak:* Black, bluish black. *Luster:* Metallic.

Optical Class: Uniaxial. *Anisotropism:* Strong; in yellows. *Birefractance:* Weak; yellow to yellow-gray.

R_1 – R_2 : (400) 18.4–29.4, (420) 18.6–30.0, (440) 18.8–30.6, (460) 18.9–31.2, (480) 19.0–31.6, (500) 19.0–31.7, (520) 18.9–31.6, (540) 18.8–31.4, (560) 18.6–31.2, (580) 18.5–30.8, (600) 18.4–30.4, (620) 18.3–30.0, (640) 18.2–29.5, (660) 18.2–28.9, (680) 18.1–28.4, (700) 18.1–28.0

Cell Data: *Space Group:* $P4_2/mnm$ (synthetic). $a = 4.4041(1)$ $c = 2.8765(1)$ $Z = 2$

X-ray Powder Pattern: Synthetic.

3.110 (100), 2.407b (55), 1.6234 (55), 1.3064 (20), 1.3045 (20), 2.110 (16), 1.5554 (14)

Chemistry:

	(1)
MnO ₂	98.72
Fe ₂ O ₃ + Al ₂ O ₃	0.09
H ₂ O	0.91
insol.	0.23
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Total	99.95

(1) Horni Blatna, Czech Republic.

Polymorphism & Series: Trimorphous with akhtenskite and ramsdellite.

Mineral Group: Rutile group.

Occurrence: Formed under highly oxidizing conditions in manganese-bearing hydrothermal deposits and rocks; in bogs and lakes, under shallow marine conditions; commonly an alteration product of manganite.

Association: Manganite, hollandite, hausmannite, braunite, chalcophanite, goethite, hematite.

Distribution: A common manganese oxide, with many localities. Well-studied material from: in Germany, at Elgersburg, Friedrichroda, and Öhrenstock, near Ilmenau, Thuringia; at Eibenstock, Saxony; in the Lindener Mark mine, near Giessen, and at Oberrossbach, Hesse; from the Eisenkaute mine, Marienberg, Rhineland-Palatinate, long crystals, and elsewhere. In good crystals from Horni Blatna (Platten), Czech Republic. At Markhemville and Hillsboro, New Brunswick, Canada. In the USA, large deposits at Ironwood, Gogebic Co., Michigan; from Leadville, Lake Co., Colorado; at Lake Valley, Sierra Co., New Mexico; in the Artillery Mountains, Mohave Co., Arizona.

Name: From the Greek for *fire* and *to wash*, as it is used to remove tints from glass.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 562–566. (2) Bolzan, A.A., C. Fong, B.J. Kennedy, and C.J. Howard (1993) Powder neutron diffraction study of pyrolusite, β -MnO₂. *Aust. J. Chem.*, 46, 939–944. (3) Ramdohr, P. (1980) The ore minerals and their intergrowths, (4th edition), 1025–1028. (4) (1972) NBS Mono. 25, 10, 39.

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