

**Crystal Data:** Monoclinic, pseudo-orthorhombic. *Point Group:*  $2/m$ . Crystals prismatic and striated || [001], short to long, to 7.5 cm; typically terminated by {001}, {h0l}, may be complex. In bundles, subparallel [001], fibrous; granular, massive. *Twinning:* Contact and penetration twins on {011}; lamellar on {100}.

**Physical Properties:** *Cleavage:* {010}, perfect; {110} and {001}, good. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 4 VHN = 630–743 (100 g load). D(meas.) = 4.29–4.34 D(calc.) = 4.38

**Optical Properties:** Opaque, transparent on thin edges. *Color:* Dark steel-gray to iron-black; red-brown in transmitted light; in reflected light, gray-white with brownish tint, with blood-red internal reflections. *Streak:* Reddish brown to nearly black. *Luster:* Submetallic. *Optical Class:* Biaxial (+). *Pleochroism:* Faint; X = reddish brown; Z = red-brown. *Orientation:* X = a; Y = b; Z  $\wedge$  c = 0°–4°. *Dispersion:* r > v, very strong. *Absorption:* Z > X = Y.  $\alpha = 2.25(2)$   $\beta = 2.25(2)$   $\gamma = 2.53(2)$  2V(meas.) = Small. *Anisotropism:* Weak. *Bireflectance:* Distinct; in grays. R<sub>1</sub>–R<sub>2</sub>: (400) 18.0–25.1, (420) 18.0–24.8, (440) 18.0–24.5, (460) 17.9–24.1, (480) 17.8–23.7, (500) 17.6–23.2, (520) 17.3–22.7, (540) 17.0–22.2, (560) 16.8–21.6, (580) 16.5–21.2, (600) 16.3–20.8, (620) 16.1–20.6, (640) 16.0–20.3, (660) 15.8–20.1, (680) 15.7–19.9, (700) 15.7–19.7

**Cell Data:** *Space Group:* B2<sub>1</sub>/d. a = 8.94 b = 5.28 c = 5.74  $\beta = 90^\circ$  Z = 8

**X-ray Powder Pattern:** Ilfeld, Germany. (ICDD 8-99). 3.40 (100), 2.64 (60), 2.28 (50), 1.708 (40), 1.636 (40), 1.139 (40), 1.672 (30)

<b>Chemistry:</b>	(1)	(2)	(3)		(1)	(2)	(3)
Al <sub>2</sub> O <sub>3</sub>	0.30	0.3		BaO	0.15		
FeO		0.5		(Na, K) <sub>2</sub> O	0.22		
MnO	79.55	79.3	80.66	OH	19.59	[19.9]	19.34
(Cu, Pb)O	0.10			gangue	0.28		
CaO	0.10			Total	100.29	[100.0]	100.00

(1) Ilfeld, Germany; average of three analyses. (2) Do.; by electron microprobe, OH by difference. (3) MnO(OH).

**Polymorphism & Series:** Trimorphous with feitknechtite and groutite.

**Occurrence:** Formed in low-temperature hydrothermal or hot-spring manganese deposits; replacing other manganese minerals in sedimentary deposits; a component in some clay deposits and laterites.

**Association:** Pyrolusite, braunite, hausmannite, barite, calcite, siderite, goethite.

**Distribution:** Many localities, but rarely well-crystallized. Fine crystals from Ilfeld, Harz Mountains, and Ilmenau, Thuringia, Germany. In the Botallack mine, St. Just, Cornwall; from Egrement, Cumbria; and at Upton Pyne, Exeter, Devonshire, England. From Granam, near Towie, Aberdeenshire, Scotland. At Bölet, near Karlsborg, Västergötland, Sweden. In the USA, good crystals from the Negaunee and Marquette districts, Marquette Co., Michigan; in the Powell's Fort mine, near Woodstock, Shenandoah Co., Virginia; and at Lake Valley, Sierra Co., New Mexico. From the Caland mine, Atikokan, Ontario, Canada. At Kuruman, Cape Province, South Africa.

**Name:** For MANGANese in the composition.

**References:** (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 646–650. (2) Dachs, H. (1963) Neutronen- und Röntgenuntersuchungen am Manganit, MnOOH. Zeits. Krist., 118, 303–326 (in German with English abs.). (3) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 350.

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