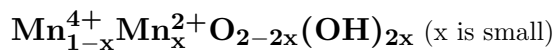


Nsutite

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Crystal Data: Hexagonal. *Point Group:* n.d. Massive, dense to porous, fine- to coarse-grained; crystals platy or wedgelike, to 50 μm ; rarely fibrous, to 2 mm, spherulitic, radiating, colloform; commonly showing shrinkage cracks when coarse.

Physical Properties: Hardness = 8.5 to 6.5 when manganoan. VHN = 1150 to 900 when manganoan (300 g load). $D(\text{meas.}) = 4.24\text{--}4.67$; to 3.86 when manganoan and with increasing H_2O content. $D(\text{calc.}) = 4.86$

Optical Properties: Opaque. *Color:* Dark gray to black; in reflected light, white with slightly creamy hue. *Luster:* Metallic to earthy.

Optical Class: Uniaxial. *Anisotropism:* Distinct; light to dark gray. *Birefractance:* Grayish white with a creamy tint to bluish gray-white.

$R_1\text{--}R_2$: n.d.

Cell Data: *Space Group:* n.d. $a = 9.65$ $c = 4.43$ $Z = 12$

X-ray Powder Pattern: Nsuta, Ghana; identification by X-ray diffraction is essential. 3.96 (vs), 2.43 (s), 2.13 (s), 1.638 (s), 2.34 (m), 1.615 (w), 1.425 (w)

Chemistry:	(1)	(2)		(1)	(2)
SiO_2	1.17	0.46	CaO	0.08	0.72
MnO_2	90.57	93.27	Na_2O	0.06	< 0.05
Al_2O_3	0.22	0.50	K_2O	0.22	0.19
Fe_2O_3	1.07	0.49	H_2O^+	2.64	2.10
MnO	2.60	1.76	H_2O^-	0.33	0.57
NiO	0.14		C	0.03	
MgO	0.12	0.22	Total	99.25	100.28

(1) Nsuta, Ghana; corresponds to $\text{Mn}_{0.90}^{4+}\text{Mn}_{0.03}^{2+}\text{Fe}_{0.01}^{3+}[\text{O}_{1.75}(\text{OH})_{0.25}]_{\Sigma=2.00}$. (2) Molango Piedras Negras, Mexico; corresponds to $\text{Mn}_{0.91}^{4+}\text{Mn}_{0.02}^{2+}\text{Fe}_{0.01}^{3+}\text{Ca}_{0.01}\text{Si}_{0.01}\text{Al}_{0.01}[\text{O}_{1.80}(\text{OH})_{0.20}]_{\Sigma=2.00}$.

Occurrence: Thought to be supergene, formed under alkaline oxidizing conditions deficient in barium and potassium.

Association: Pyrolusite, cryptomelane, romanèchite, chalcophanite, other Mn oxides, rhodochrosite, quartz, goethite.

Distribution: Widespread, may be in large amounts. Well-characterized material from: Nsuta, Ghana. At Mokuta, Ivory Coast. In the Orient mine, Krugersdorp, Transvaal, and near Kuruman, Cape Province, South Africa. At Tartana, 32 km north of Drama, Macedonia. From Philipsburg, Granite Co., Montana, and the Hardshell mine, Santa Cruz Co., Arizona, USA. From Molango Piedras Negras, Hidalgo, Mexico. On Groote Eylandt, Northern Territory, Australia. In Germany, at Bülten-Adenstadt, Lower Saxony. From Bihain, near Salmchâteau, Belgium.

Name: For Nsuta, Ghana, a prominent occurrence.

Type Material: n.d.

References: (1) Zwicker, W.K., W.O.J. Groeneveld Meijer, and H.W. Jaffe (1962) Nsutite—a widespread manganese oxide mineral. *Amer. Mineral.*, 47, 246–266. (2) Faulring, G.M. (1965) Unit cell determination and thermal transformations of nsutite. *Amer. Mineral.*, 50, 170–179. (3) Ostwald, J. (1984) Some observations on the genesis of nsutite. *Neues Jahrb. Mineral., Monatsh.*, 385–392.