

Crystal Data: Cubic. *Point Group:* $4/m\bar{3}2/m$. Commonly as octahedra, to 30 cm, may show dodecahedron or cube faces, rarely as dodecahedra; coarse granular, rounded, massive.

Twinning: On {111} as both twin and composition plane, the spinel law, by penetration or contact, may be repeated as sixlings.

Physical Properties: *Cleavage:* Parting on {111}. *Fracture:* Conchoidal, uneven to splintery. *Tenacity:* Brittle. Hardness = 7.5-8 D(meas.) = 3.6-4.1, increasing with Fe and Zn content. D(calc.) = 3.578

Optical Properties: Transparent to nearly opaque. *Color:* Colorless, brown, black; red, orange, yellow, green, blue, indigo, violet. *Streak:* White. *Luster:* Vitreous, splendent to dull. *Optical Class:* Isotropic. $n = 1.719$

Cell Data: *Space Group:* $Fd\bar{3}m$ (synthetic). $a = 8.0898(9)$ $Z = 8$

X-ray Powder Pattern: Synthetic.

2.437 (100), 2.020 (65), 1.4289 (55), 1.5554 (45), 2.858 (40), 4.66 (35), 1.0524 (12)

Chemistry:	(1)	(2)	(3)		(1)	(2)	(3)
SiO ₂	0.02	0.56		MnO		0.68	
TiO ₂	0.05			ZnO	0.33	16.47	
Al ₂ O ₃	70.08	57.99	71.67	MgO	28.77	14.08	28.33
Fe ₂ O ₃		6.94		CaO		0.33	
FeO	0.33	3.23		Total	99.58	100.28	100.00

(1) "South East Asia"; corresponds to Mg_{1.00}(Al_{1.97}Mg_{0.02}Fe_{0.01}Zn_{0.01})_{Σ=2.01}O₄. (2) Kaveltorp, Sweden; corresponds to (Mg_{0.57}Zn_{0.33}Fe²⁺_{0.07}Mn²⁺_{0.02}Ca_{0.01})_{Σ=1.00}(Al_{1.84}Fe³⁺_{0.14}Si_{0.02})_{Σ=2.00}O₄. (3) MgAl₂O₄.

Polymorphism & Series: Forms series, with magnesiochromite, gahnite, and hercynite.

Mineral Group: Spinel supergroup, oxyspinel group, spinel subgroup.

Occurrence: A common mineral, formed at high-temperatures as an accessory in igneous rocks, principally basalts, kimberlites, peridotites, and in xenoliths; in regionally metamorphosed aluminum-rich schists; in regionally and contact metamorphosed limestones; a detrital mineral.

Association: Forsterite, chondrodite, scapolite, phlogopite, corundum, sillimanite, andalusite.

Distribution: Many localities. Some for good specimens include gem crystals from around Mogok, Myanmar (Burma) and in Sri Lanka, in the Ratnapura and Elahera districts, and elsewhere. In the USA, at many places from Amity and Edenville, Orange Co., New York to Andover, Allegany Co., New Jersey; fine crystals from Franklin and Sterling Hill, Ogdensburg, Sussex Co., New Jersey. From near Midland, and at the Crestmore quarry, Riverside Co., California. In Canada, at Burgess, Ontario, and Wakefield, Quebec. In the Eifel district, and at Bodenmais, Bavaria, Germany. On Monte Somma and Vesuvius, Campania, Italy. From Andrahomana, Ambinda, Besakoa, and many other places in Madagascar. Large crystals from the Emeldjak and Katalakhu deposits, in the Aldan Shield, Sakha, Russia. At Gorondarinskoye, Pamir Mountains, Tajikistan.

Name: Perhaps from the Latin *spinella*, for *little thorn*, in allusion to the spine-shaped octahedral crystals.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 689-697. (2) Deer, W.A., R.A. Howie, and J. Zussman (1962) Rock-forming minerals, v. 5, non-silicates, 56-88, esp. 62-67. (3) Finger, L.W., R.M. Hazen, and A.M. Hofmeister (1986) High-pressure crystal chemistry of spinel (MgAl₂O₄) and magnetite (Fe₃O₄): comparisons with silicate spinels. *Phys. Chem. Minerals*, 13, 215-220. (4) (1971) NBS Mono. 25, 9, 25. (5) Bosi, F., C. Biagioni, and M. Pasero (2019) Nomenclature and classification of the spinel supergroup. *Eur. J. Mineral.*, 31, 183-192.