Polydymite $NiNi_2S_4$

Crystal Data: Cubic. *Point Group:* $4/m\ \overline{3}\ 2/m$. Crystals are dominantly octahedral, to 1 cm; also massive, granular to compact. *Twinning:* On {111}.

Physical Properties: *Cleavage:* Imperfect on {001}; reported on {111}. *Fracture:* Subconchoidal to uneven. Hardness = 4.5–5.5 VHN = 379–427 (100 g load). D(meas.) = 4.5–4.8 D(calc.) = 4.83

Optical Properties: Opaque. *Color:* Pale gray to steel-gray, tarnishing to copper-red. *Luster:* Metallic, brilliant on fresh surface.

R: (400) 44.3, (420) 44.8, (440) 45.3, (460) 45.7, (480) 46.0, (500) 46.2, (520) 46.2, (540) 46.0, (560) 45.8, (580) 45.8, (600) 46.2, (620) 46.9, (640) 48.0, (660) 49.6, (680) 51.2, (700) 53.0

Cell Data: *Space Group: Fd3m.* a = 9.405 Z = 8

X-ray Powder Pattern: Siegen, Germany.
2.87 (100), 1.678 (80), 2.37 (60), 1.825 (50), 0.994 (50), 1.060 (40), 3.36 (30)

Chemistry:

	(1)	(2)	(3)
Ni	54.30	55.2	57.86
Fe	3.98	3.1	
Co	0.63	0.8	
S	41.09	41.2	42.14
Total	[100.00]	100.3	100.00

(1) Grünau mine, Germany; recalculated to 100% after deducting gersdorffite and ullmannite 5%; then corresponds to $(Ni_{2.83}Fe_{0.22}Co_{0.03})_{\Sigma=3.08}S_{3.92}$. (2) Madziwa mine, Zimbabwe; by electron microprobe, corresponds to $(Ni_{2.87}Fe_{0.17}Co_{0.04})_{\Sigma=3.08}S_{3.92}$. (3) Ni_3S_4.

Polymorphism & Series: Forms a series with linnaeite.

Mineral Group: Linnaeite group.

Occurrence: In hydrothermal veins.

Association: Chalcopyrite, pyrrhotite, pyrite, millerite, gersdorffite, ullmannite, sphalerite, galena, bismuthinite, quartz, siderite.

Distribution: In Germany, in the Grünau mine, Daaden, near Siegen [TL], and at Ramsbeck, North Rhine-Westphalia. From Saint Marina, Khaskovo district, Bulgaria. At Kunratice and Rozany, Czech Republic. From Novo-Aidyrlinsk, Southern Ural Mountains, and the Noril'sk region, western Siberia, Russia. In the USA, from Hamilton, Hancock Co., Illinois; in the Miliken (Sweetwater) mine, Reynolds Co., Missouri; and at the Copper King mine, Gold Hill district, Boulder Co., Colorado. In the Madziwa (Dry Nickel) mine, Bindura; and at Shamva, Zimbabwe. Large cystals from Shinkolobwe, Katanga Province, Congo (Shaba Province, Zaire). At Jabal Mardah, Saudi Arabia. From Kalgoorlie, Western Australia.

Name: From the Greek for *many* and *twin*, as the mineral is observed in twinned forms.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 262–265. (2) Vaughan, D.J. and J.R. Craig (1985) The crystal chemistry of iron-nickel thiospinels. Amer. Mineral., 70, 1036–1043. (3) Berry, L.G. and R.M. Thompson (1962) X-ray powder data for the ore minerals. Geol. Soc. Amer. Mem. 85, 78. (4) Ramdohr, P. (1969) The ore minerals and their intergrowths, (3rd edition), 686–691. (5) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 448.