Niningerite $(Mg, Fe^{2+}, Mn)S$

Crystal Data: Cubic. *Point Group:* $4/m\ \overline{3}\ 2/m$. As grains intimately intergrown with kamacite and troilite; grains may contain oriented exsolution lamellae of troilite and minute grains of kamacite.

Physical Properties: Hardness = n.d. VHN = n.d. D(meas.) = n.d. D(calc.) = 3.21–3.59

Optical Properties: Opaque. *Color:* Gray in reflected light. *Luster:* Metallic.
R: n.d.

Cell Data: *Space Group:* $Fm3m$ (by analogy to synthetic). a = 5.17(2) Z = 4

X-ray Powder Pattern: Synthetic MgS.
2.601 (100), 1.8388 (60), 1.5010 (16), 1.1630 (14), 1.0617 (10), 3.004 (8), 1.3001 (8)

Chemistry:

	(1)	(2)	(3)
Mg	18.3	23.5	16.84
Fe	27.0	15.6	38.72
Mn	6.5	11.6	
Ca	1.28	0.39	
Cr	1.66	0.14	
S	43.4	46.9	44.45
Total	98.14	98.13	100.00

(1) Indarch meteorite; by electron microprobe, corresponds to $(Mg_{0.56}Fe_{0.36}Mn_{0.09}Ca_{0.02}Cr_{0.02})_{\Sigma=1.05}S_{1.00}$. (2) Kota-Kota meteorite; by electron microprobe, corresponds to $(Mg_{0.66}Fe_{0.19}Mn_{0.14}Ca_{0.01})_{\Sigma=1.00}S_{1.00}$. (3) (Mg, Fe)S with Mg:Fe = 1:1.

Mineral Group: Galena group.

Occurrence: In less extensively metamorphosed enstatite chondrite meteorites.

Association: "Nickel-iron" (kamacite), troilite.

Distribution: In the Indarch [TL], St. Marks [TL], Kota-Kota [TL], Qingzhen, Yamoto 691, Yamoto 74370, South Oman, Kaidun, etc. enstatite chondrite meteorites.

Name: In honor of Harvey Harlow Nininger (1887–1986), of Sedona, Arizona, USA, for his contributions to meteoritics.

Type Material: n.d.

References: (1) Klaus, K. and K.G. Snetsinger (1967) Niningerite: a new meteoric sulfide. Science, 155, 451–453. (2) (1967) Amer. Mineral., 52, 925 (abs. ref. 1). (3) Leitch, C.A. and J.V. Smith (1982) Petrography, mineral chemistry and origin of type I enstatite chondrites. Geochim. Cosmochim. Acta, 46, 2083–2097. (4) Ehlers, K. and A. El Goresy (1988) Normal and reverse zoning in niningerite: a novel key parameter to the thermal histories of EH-chondrites. Geochim. Cosmochim. Acta, 52, 877–887. (5) (1957) NBS Circ. 539, 7, 31.