Dwornikite $(Ni, Fe^{2+})SO_4 \cdot H_2O$

Crystal Data: Monoclinic (by analogy to kieserite group). *Point Group:* $2/m$. As aggregates of anhedral grains, to 1 μm, intermixed with other species.

Physical Properties: *Fracture:* [Conchoidal to uneven.] (by analogy to szomolnokite). *Tenacity:* [Brittle.] Hardness = [2.5] D(meas.) = n.d. D(calc.) = 3.357 [Slowly soluble in H_2O.]

Optical Properties: Semitransparent. *Color:* White, may have a greenish tint from impurities. *Luster:* [Vitreous.]
Optical Class: Biaxial, with fairly strong birefringence. $n = 1.63$ α = n.d. β = n.d. γ = n.d. 2V(meas.) = n.d.

Cell Data: *Space Group:* $C2/c$ (synthetic). $a = 6.824(2)$ $b = 7.594(2)$ $c = 7.457(1)$ $\beta = 117.79(1)^\circ$ Z = 4

X-ray Powder Pattern: Minasragra, Peru.
3.342 (100), 4.732 (70), 3.024 (70), 4.754 (50), 3.293 (35), 2.4912 (35), 3.792 (25)

Chemistry:

	(1)
SO_3	42.4
FeO	9.3
NiO	39.0
H_2O	n.d.
Total	

(1) Minasragra, Peru; by X-ray fluorescence, average of four partial analyses; corresponds to $(Ni_{0.80}Fe_{0.20})_{\Sigma=1.00}(SO_4)_2 \cdot H_2O$.

Mineral Group: Kieserite group.

Occurrence: In a vanadium sulfide deposit, probably by oxidation of associated bravoite.

Association: Patronite, sulfur, retgersite, szomolnokite, "bitumen".

Distribution: At Minasragra, 46 km from Cerro de Pasco, Peru.

Name: Honors Edward J. Dwornik (1920–), Lunar geologist and mineralogist, U.S. Geological Survey, Washington, D.C., USA, who studied several vanadium deposits.

Type Material: George Washington University, Washington, D.C., USA.

References: (1) Milton, C., H.T. Evans, Jr., and R.G. Johnson (1982) Dwornikite, $(Ni, Fe)SO_4 \cdot H_2O$, a member of the kieserite group from Minasragra, Peru. Mineral. Mag., 46, 351–355. (2) (1983) Amer. Mineral., 68, 642 (abs. ref. 1). (3) Wildner, M. and G. Giester (1991) The crystal structures of kieserite-type compounds. I. Crystal structures of $Me(II)SO_4 \cdot H_2O$ (Me = Mn,Fe,Co,Ni,Zn). Neues Jahrb. Mineral., Monatsh., 296–306.