Nickelphosphide Ni_3P

Crystal Data: Tetragonal. *Point Group*: $\bar{4}$. As isometric grains, to 30 μm, in kamacite lamellae and as xenomorphous elongate inclusions, to 200 μm, in kamacite spindles.

Physical Properties: *Cleavage*: None. *Tenacity*: Brittle. VHN = 841-905, 874 average (25 g load). Hardness = n.d. D(meas.) = n.d. D(calc.) = 7.61

Optical Properties: Opaque. *Color*: In reflected light, white with a pink-yellow tint.
Luster: Metallic.
Optical Class: Biaxial (+). No anisotropy observed in air, but weakly anisotropic in yellowish pinkish colors in oil (n = 1.515). No bireflectance.
R_1-R_2: (480) 44.6-43.0, (560) 48.3-46.8, (580) 49.1-47.6, (660) 52.5-51.3

Cell Data: *Space Group*: $I\bar{4}$. a = 8.9546(1)(1) c = 4.38714(8) Z = 8

X-ray Powder Pattern: Synthetic.
2.17 (100), 1.995 (70), 2.13 (50), 2.08 (50), 2.48 (20), 2.01 (20)

Chemistry:

	(1)	(2)
Fe	33.4	35.3
Ni	52.9	49.6
Co	0.0	0.2
P	14.6	15.3
Total	100.9	100.6

(1) Butler meteorite; electron microprobe analysis; corresponding to $(Ni_{1.83}Fe_{1.21})_{\Sigma=3.04}P_{0.96}$.
(2) Do.; electron microprobe analysis; corresponding to $(Ni_{1.71}Fe_{1.28}Co_{0.01})_{\Sigma=3.00}P_{1.00}$.

Polymorphism & Series: Solid solution series with Fe_3P.

Occurrence: In meteorites.

Association: Kamacite, taenite, carlsbergite, schreibersite, barringerite (Butler); allabogdanite (Onello).

Distribution: In iron meteorites: Butler [TL], Cañon Diablo, Carlton, Edmonton (Kentucky), Kenton County, Lenarto, Monahans, Oktibbeha County; also, in the Efremovka carbonaceous chondrite, the Onello ataxite, and the Vicenice octahedrite.

Name: Alludes to the composition.

Type Material: Mining Museum, Saint Petersburg Mining Institute, Russia.

References: (1) Britvin, S.N., V.D. Kolomensky, M.M. Boldyreva, A.N. Bogdanova, Yu.L. Kretser, O.N. Boldyreva, and N.S. Rudashevskii (1999) Nickelphosphide, $(Ni,Fe)_3P$, the nickel analog of schreibersite. Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva, 128, 64-72 (in Russian). (2) (2000) Amer. Mineral., 85, 875 (abs. ref. 1). (3) Skála, R. and M. Drábek (2003) Nickelphosphide from the Vicenice octahedrite: Rietveld crystal structure refinement of a synthetic analogue. Mineral. Mag., 67, 783-792.