Chekhovichite $Bi_2Te_4^{4+}O_{11}$

Crystal Data: Monoclinic. *Point Group:* $2/m$. As subhedral platy grains, to 0.1 mm, in crusts and aggregates. *Twinning:* Polysynthetic, parallel elongation.

Physical Properties: *Cleavage:* One, ‖ elongation, perfect; another at 87° to the first, less perfect. Hardness = ∼4 VHN = 205–325, 290 average (100 g load). D(meas.) = 6.88(1.5) D(calc.) = 7.00

Optical Properties: Semitransparent. *Color:* Grayish yellow, pale gray, or grayish green; pale gray to gray with white internal reflections in reflected light. *Streak:* White. *Luster:* Adamantine.
Optical Class: Biaxial (+). *Orientation:* $X \wedge c = 21°$; $Z \wedge a = 25°$. *Dispersion:* $r < v$, distinct. $\alpha = 2.45(2)$ $\beta = 2.50(2)$ $\gamma = 2.65(2)$ 2V(meas.) = 65(3)° *Anisotropism:* Marked. *Bireflectance:* Observable.
R_1–R_2: (400) 18.9–21.4, (420) 18.8–21.4, (440) 18.7–21.3, (460) 18.6–21.3, (480) 18.3–21.2, (500) 18.1–21.2, (520) 18.1–21.1, (540) 17.9–21.0, (560) 17.7–20.8, (580) 17.6–20.7, (600) 17.4–20.6, (620) 17.3–21.5, (640) 17.3–20.4, (660) 17.2–20.3, (680) 17.2–20.2, (700) 17.1–20.2

Cell Data: *Space Group:* $P2_1/n$ (synthetic). $a = 18.8963(8)$ $b = 7.9593(3)$ $c = 6.9909(3)$ $\beta = 95.176(3)°$ Z = 4

X-ray Powder Pattern: Zod deposit, Armenia.
3.29 (100), 3.14 (100), 3.15 (94), 2.728 (48), 1.998 (45), 2.002 (42), 1.686 (32)

Chemistry:

	(1)	(2)
TeO_2	57.9	57.81
Bi_2O_3	41.5	42.19
Sb_2O_3	trace	
FeO	0.1	
PbO	0.8	
CuO	trace	
Total	100.3	100.00

(1) Zod deposit, Armenia; by electron microprobe, originally an elemental analysis, totaling 100.4%, here converted to oxides; corresponds to $(Bi_{1.96}Pb_{0.04}Fe_{0.02})_{\Sigma=2.02}Te_{3.99}O_{10.99}$.
(2) $Bi_2Te_4O_{11}$.

Occurrence: A rare oxidation product of earlier tellurium-bearing minerals.

Association: Tellurobismuthite, pyrite, chalcopyrite, emmonsite, tripuhyite, "limonite", quartz.

Distribution: From the Zod deposit, 14 km east of Vardenis, Armenia. At the Zhana-Tyube and Northern Aksu deposits, north Kazakhstan.

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Type Material: Mining Museum, Leningrad, 1945/1; A.E. Fersman Mineralogical Museum, Academy of Sciences, Moscow, Russia, 88052.

References: (1) Spiridonov, E.M., I.V. Petrova, L.A. Demina, V.I. Dolgikh, and G.M. Antonyan (1987) The new mineral chekhovichite ($Bi_2Te_4O_{11}$). Moscow University Geology Bulletin, 42(6), 71–75 (in English). (2) (1989) Amer. Mineral., 74, 1400 (abs. ref. 1). (3) Rossell, H.J., M. Leblanc, G. Férey, D.J.M. Bevan, D.J. Simpson, and M.R. Taylor (1992) On the crystal structure of $Bi_2Te_4O_{11}$. Aust. J. Chem. 45, 1415–1425.