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REFERENCES

BRAGG, W. L. (1924) *Proc. Roy. Soc.* (London) **105A,** 16–39.

BROOKS, R., L. M. CLARK AND E. F. THURSTON (1950) *Trans. Roy. Soc. London.* **A243,** 145–67.

CHAUDRON, G., H. MONDANGE, AND M. PRUNA (1952). *Proc. Intern. Symposium Reactivity of Solids*, Gothenburg, 9–20 (in French).

FAUST, G. T. (1949) *Science.* **110,** 402–3.

——— (1950) *Am. Mineral.* **35,** 207.

FAIVRE, R. (1946) *Compt. rend.* **222,** 140-141.

GRUVER, R. M. (1950) *Jour. Am. Cer. Soc.* **33,** 171.

IEVINS, A., F. OSIS AND F. MATEURS (1955) *Latvijas PSR Zinatum Akad. Vestis.* **2,** 87–100 (in Russian).

DE KEYSER, W. L. AND L. DUGNELDRE (1950) *Bull. Soc. Chim. Belges.* **59,** 40–71.

KITANO, Y., K. PARK AND DONALD W. HOOD (1962). *Jour. Geophys. Res.* **67,** 4873–4874.

SWANSON, H. E. AND R. K. FUYAT (1954) *NBS Circ.* **539,** 3, 53–4.

WRAY, J. L. AND FARRINGTON DANIELS (1957) *Jour. Am. Chem. Soc.* **79,** 2031–2034.

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CRYSTALLOGRAPHIC DATA FOR Er_2SiO_5 AND Y_2SiO_5[1]

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Recent phase equilibria investigations of rare-earth oxide–silicon dioxide systems and their compounds have been the subject of studies by Warshaw and Roy (1961) and Toropov *et al.* (1961). Of specific interest to this paper are the compounds Er_2SiO_5 and Y_2SiO_5, data for which were reported by both sets of authors. However, a comparison of the powder *x*-ray diffration data for these two compounds as given by Warshaw and Roy with that given by Toropov *et al.* for the identical compounds are not in agreement.

Recently, we have synthesized single crystals of Er_2SiO_5 and Y_2SiO_5 by solution growth from a molten $Li_2O \cdot 2MoO_3$ solvent at approximately 1100° C. Spectrochemical analyses of the erbium compound showed only significant quantities of erbium and silicon with less than 0.1% Mo present. Confirmation of the formula was obtained by solid state synthesis of these compounds. This was accomplished by physically mixing powders

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TABLE 1. COMPARISON OF PHYSICAL PROPERTIES AND *X*-RAY POWDER DIFFRACTION DATA FOR Er_2SiO_5 OF TOROPOV *et al.* AND PRESENT AUTHORS

	Toropov *et al.*		Present[1] authors		
Optic figure	biaxial		biaxial		
Refractive indices	$\gamma = 1.825$		$\gamma \cong 1.825$		
	$\alpha = 1.807$		$\alpha \cong 1.810$		
2V (estimated)	88°		~90°		
Density (measured g·cm^{-3})	6.8		6.87		
	Diffraction Data				
	I	d(A)	I[2]	d(A)	hkl
			M	6.075	002
			M	5.884	011
			VVW	5.566	110
			VVW	5.012	200
			W	4.380	$\bar{1}12$, $\bar{2}02$
	12	4.08	M	4.048	$\bar{2}11$
	46	3.92	VS	3.883	112
			VVW	3.628	211
	41	3.55	S	3.531	202
			VVW	3.445	013
	12	3.37	MW	3.337	020
	54	3.15	S	3.129	$\bar{1}21$
	82	3.03	VS	3.004	310
	100	2.93	S	2.925	022
			VS	2.885	$\bar{2}04$
			W	2.792	220
	30	2.67	M	2.653	$\bar{2}22$
			W	2.631	213
	20	2.61	M	2.583	$\bar{1}23$
	68	2.55	VS	2.533	114
	43	2.42	M	2.412	123
	36	2.27	MS	2.255	024
			MW	2.235	411
	93	2.19	MW	2.186	031
			S	2.172	130
			W	2.035	$\bar{2}31$

[1] The *x*-ray powder diffraction data were obtained from Debye-Scherrer films using Cu Kα ($\lambda = 1.5418$ Å) radiation.

[2] S = strong; VS = very strong; M = medium; MW = medium weak; MS = medium strong; W = weak; VW = very weak; and VVW = very very weak.

(the purity of these powders are 99.95 wt % Y_2O_3, 99.9 wt % Er_2O_3, and 99.95 wt % SiO_2) of the constituent oxides in their proper proportions, then pelletizing this mixture and firing the pellet at a temperature greater

TABLE 2. *X*-RAY DIFFRACTION DATA FOR Er_2SiO_5 AND Y_2SiO_5 BASED ON SINGLE CRYSTALS

	Er_2SiO_5	Y_2SiO_5
Color	Pink	Water clear
Lattice parameters		
a	10.33±0.03 Å	10.34±0.02 Å
b	6.689±0.016 Å	6.689±0.015 Å
c	12.37±0.02 Å	12.38±0.03 Å
β	102°57'	102°32'
Z	8	8
$\rho_0(g \cdot cm^{-3})$	6.86	[1]
$\rho_{x\text{-ray}}(g \cdot cm^{-3})$	7.057	4.55
Possible space groups	*Ic*, *I2/c*	*Ic*, *I2/c*

[1] Sample was too small for accurate determination.

than 1450° C. for 24 hr, in air, using a 60% Pt-40% Rh wound vertical tube furnace. The product obtained on air quenching was examined optically and by *x*-ray diffraction and found to be essentially a single phase, giving a diffraction pattern identical to the one obtained from powdered single crystals.

The diffraction data obtained in this study for Er_2SiO_5 and Y_2SiO_5 were found to differ from those reported by Warshaw and Roy for identical compounds. However, a comparison of physical properties and *x*-ray diffraction data (Table 1) for Er_2SiO_5 given by Toropov *et al.* and the present authors shows them to be the same with the exception that the weaker reflections were not observed by Toropov *et al.*

The crystallographic data for Er_2SiO_5 and Y_2SiO_5 are summarized in Table 2. Rotation, Weissenberg, and precession films were obtained from crystals of both compounds using Cu Kα($\lambda = 1.5418$ Å) and Mo Kα ($\lambda = 0.7107$ Å) radiations where appropriate.

REFERENCES

WARSHAW, I. AND R. ROY (1961) Crystal chemistry of rare earth sesquioxides, aluminates, and silicates. *Progress in the Science and Technology of the Rare Earths*, Vol. 1, ed. by Leroy Eyring, Pergamon Press, New York, 203–221.

TOROPOV, N. A. AND J. A. BONDAR' (1961) Silicates of the rare earth oxides. Phase diagrams of the binary oxide system Y_2O_3-SiO_2. *Izv. Akad. Nauk SSSR Otd. Khim. Nauk*, 544–550 (in Russian).

——— *et al.* (1961) Silicates of the rare earth oxides. Phase diagrams of the binary oxide systems Dy_2O_3-SiO_2 and Er_2O_3-SiO_2. *Izv. Akad. Nauk SSSR Otd. Khim. Nauk*, **8**, 1365–1371 (in Russian).