APPENDIX A

JCPDS File of KNN

Name and formula

Reference code:	01-077-0038
ICSD name:	Sodium Potassium Niobium Oxide
Empirical formula:	$K_{0.65}Na_{0.35}NbO_3$
Chemical formula:	$Na_{0.35}K_{0.65}NbO_3$

Crystallographic parameters

Crystal system:	Monoclinic
Space group:	Pm
Space group number:	6
a (?):	7.9751
b (?):	7.8620
c (?):	7.9565
Alpha (?):	90.0000
Beta (?):	90.3400
Gamma (?):	90.0000
Calculated density (g/cm^3):	4.64
Volume of cell (10^6 pm^3):	498.87
Z:	8.00
RIR:	2.48

Subfiles and Quality

Subfiles:	Inorganic
	Corrosion

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Modelled additional pattern

Quality: Calculated (C)

Comments

ICSD collection code: 038004

References

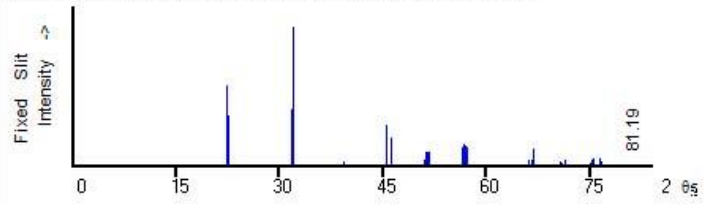
Primary reference: *Calculated from ICSD using POWD-12++*, (1997)

Structure: Athee, M., Hewat, A.W., *Acta Crystallogr., Sec. A*, **34**, 309, (1978)

Peak list

77-0038 Quality: C
CAS Number:
Molecular Weight: 174.36
Volume[CD]: 498.87
Dx: 4.643 Dm:
Sys: Monoclinic
Lattice: Primitive
S.G.: Pm (6)
Cell Parameters:
a 7.975 b 7.862 c 7.956
α β 90.340 γ
I/Icor: 2.48
Rad: CuKa1
Lambda: 1.54060
Filter:
d-sp: calculated
ICSD # : 038004

Na0.35 K0.65 Nb O3
Sodium Potassium Niobium Oxide
Ref: Calculated from ICSD using POWD-12++, (1997)
Ref: Athee, M., Hewat, A.W., Acta Crystallogr., Sec. A, 34, 309 (1978)



2θ	Int-f	h	k	l	2θ	Int-f	h	k	l	2θ	Int-f	h	k	l
11.112	1	1	0	0	34.187	1	0	3	0	45.569	288	0	0	4
11.112	1	0	0	1	35.582	3	-1	0	3	46.147	199	0	4	0
11.245	1	0	1	0	35.582	3	3	1	0	47.089	1	0	1	4
15.674	2	-1	0	1	35.712	3	0	1	3	47.089	1	1	0	4
15.768	3	1	0	1	35.712	3	1	0	3	47.276	1	-2	2	3
15.768	3	0	1	1	37.490	1	3	1	1	47.276	1	-2	3	2
19.409	1	1	1	1	37.556	1	-1	1	3	47.414	1	-2	3	2
22.277	578	2	0	0	37.854	1	-1	3	1	48.291	1	-3	0	3
22.277	578	0	0	2	37.854	1	1	3	1	48.464	1	-1	1	4
22.601	353	0	2	0	39.243	25	-2	2	2	48.597	1	3	0	3
25.020	1	2	1	0	39.404	16	-2	2	2	48.597	1	1	1	4
25.020	1	0	1	2	40.714	1	-3	0	2	48.756	1	-3	3	0
27.678	1	-1	2	1	40.714	1	-2	0	3	49.066	1	-1	4	1
27.678	1	-1	2	1	41.020	1	0	2	3	49.066	1	1	4	1
31.651	343	-2	0	2	41.217	1	2	3	0	50.218	1	3	3	1
31.844	406	2	0	2	41.217	1	0	3	2	50.218	1	-1	3	3
31.944	999 *	2	2	0	42.567	4	-1	2	3	51.080	35	-4	0	2
31.944	999 *	0	2	2	42.567	4	2	1	3	51.157	47	-2	0	4
33.769	1	0	0	3	42.679	6	3	2	1	51.343	98	4	0	2
33.872	1	-2	1	2	42.679	6	-1	2	3	51.343	98	4	2	0
33.872	1	-1	2	2	42.777	2	-1	3	2	51.445	101	2	0	4
33.992	1	2	2	1	42.777	2	2	3	1	51.445	101	0	2	4
33.992	1	1	2	2	45.456	215	4	0	0	51.817	102	2	4	0

APPENDIX B

Tellurium Dioxide, TeO_2 Data

Name and formula

Name	Tellurium Dioxide
Other names	Tellurium (IV) oxide
Chemical formula	TeO_2
Molar mass	159.60 g/mol
Appearance	white solid
Density	5.670 g/cm^3 (orthorhombic)
	6.04 g/cm^3 (tetragonal)
Melting point	732 °C (1,350 °F; 1,005 K)
Boiling point	1,245 °C (2,273 °F; 1,518 K)
Solubility in water	negligible
Solubility	soluble in acid and alkali
Refractive index (n_D)	2.24

Structure

Paratellurite, α-TeO_2, converts at high pressure into the β-, tellurite form. Both the α-, (paratellurite) and β- (tellurite forms) contain four coordinate Te with the oxygen atoms at four of the corners of a trigonal bipyramid. In paratellurite all vertices are shared to give a rutile-like structure, where the O-Te-O bond angle are 140°. α-TeO_2 In tellurite pairs of trigonal pyramidal, TeO_4 units, sharing an edge, share vertices to then form a layer. The shortest Te-Te distance in tellurite is 317 pm, compared to 374 pm in paratellurite. Similar Te_2O_6 units are found in the mineral denningite.

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	2005-2008	B.Sc. in Materials Science Department of Physics and Materials Science, Chiang Mai University, Thailand
Scholarship	2007-2008	Received "Industrial and Research Project for Undergraduate Students Research: IRPUS", The Thailand Research Fund (TRF)
	2007-2008	Received "Young Scientist and Technologist Program: YSTP" Scholarship for senior project National Science and Technology Development Agency (NSTDA)
	2009-2010	Received "Thailand Graduate Institute of Science and Technology: TGIST" Scholarship for Master degree thesis

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National Science and Technology Development Agency (NSTDA)

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National Science and Technology Development Agency (NSTDA)

Publications

P. Yongsiri, K. Pengpat, "Materials Characterization of Potassium Sodium Niobate based Tellurite Glass-Ceramics", Int. Ferroelectrics., 141 (2013) 154-166.

P. Yongsiri, N. Phupradit, S. Sirisoonthorn, K. Pengpat, "Microstructure and Optical Properties of Er_2O_3 Doped Potassium Sodium Niobate Tellurite Glass-ceramics", Proceeding of 2013 Joint UFFC, EFTF and PFM Symposium, IEEE.

P. Yongsiri, S. Eitssayeam, S. Sirisoonthorn, and K. Pengpat, "Morphology of Potassium Sodium Niobate based Silicate Glass System", Electron. Mater. Lett., 9 (2013).

P. Yongsiri, P. Mhuangthong, A. Munpakdee, K. Pengpat, "Preparation of Potassium Sodium Niobate in Tellurite Glass System Doped with Er_2O_3", Ferroelectrics, 459 (2014) 153-159.

Experience

Presentations in National and International Conferences and Meetings

1) P. Yongsiri, K. Pengpat and S. Sirisoonthorn, "Preparation of glass ceramic containing ferroelectric $(K_{0.5}Na_{0.5})NbO_3$ crystals", Poster presentation, The 35th Congress on Science and Technology of Thailand (STT35), Tide resort hotel, Bang-san, Chonburi, Thailand, October 15-17, 2009.

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2) P. Yongsiri, K. Pengpat and S. Sirisoonthorn, "Fabrication of Ferroelectric Glass Ceramics from $(K_{0.5}Na_{0.5})NbO_3$-SiO_2-Al_2O_3 Glass System", Poster presentation, Symposium on ferroelectricity (RCBJSF-10), Tokyo Institute of technology Materials and Structure Laboratory, Yokohama, Japan, June 21-24, 2010.

3) P. Yongsiri, K. Pengpat and S. Sirisoonthorn, "Crystal Structural Development of $(K_{0.5}Na_{0.5})NbO_3$-SiO_2-Al_2O_3 based Glass-ceramics System "Poster presentation, The 28th Annual Conference of The Microscopy Society of Thailand (MST 28), Mae Fah Luang University, Chiang Rai, Thailand, January 5-7, 2011.

4) P. Yongsiri, K. Pengpat, S. Sirisoonthorn, G. Rujijanagul, S. Eitssayeam and T. Tunkasiri, "Fabrication of Lead-free Ferroelectric Glass-Ceramic from Potassium Sodium Niobate based System", Poster presentation, The 2011 International Forum on Functional Materials (IFFM2011) and the 2nd Special Symposium on Advances in Functional Materials (AFM-2), Jeju grand Hotel, Jeju, Korea, July 28-31, 2011.

5) P. Yongsiri, S. Eitssayeam, G. Rujijanagul, S. Sirisoonthorn, T. Tunkasiri and K. Pengpat, "Effect of Boron Oxide on Phase and Electrical Properties of $(K_{0.5}Na_{0.5})NbO_3$ based Ferroelectric Glass Ceramics", Poster presentation, The Pure and Applied Chemistry International Conference (PACCON2012), The Empress Hotel Chiang Mai, Chiang Mai, Thailand, January 11-13, 2012.

6) P. Yongsiri and K. Pengpat, "Structural Properties of Potassium Sodium Niobate based Tellurite Glass System",

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Poster presentation, The International Symposium on Integrated Functionalities (ISIF2012), The Hong Kong Polytechnic University, Hong Kong, The Republic of China, June 18-21, 2012.

7) P. Yongsiri and K. Pengpat, "The Study of Potassium Sodium Niobate based Silicate Glass System", Poster presentation, The International Conference on Electronic Materials and Nanotechnology and Green Environment (ENGE2012), Ramada Plaza Jeju Hotel, Jeju, Korea, September 16-19, 2012.

8) P. Yongsiri, A. Munpakdee and K. Pengpat, "Preparation of Potassium Sodium Niobate in Tellurite Glass System Doped with Er_2O_3", Oral presentation, The 8th Asian Meeting on Ferroelectrics (AMF-8), Amari Orchid Hotel, Pattaya, Thailand, December 9-14, 2012.

9) P. Yongsiri and K. Pengpat, "Microstructure and Optical Properties of Er_2O_3 -Doped Potassium Sodium Niobate-Tellurite Glass-ceramics", Poster presentation, The 2013 Joint UFFC, EFTF and PFM Symposium, Prague, Crezh Republic, July 21-25, 2013.

10) P. Yongsiri and K. Pengpat, "Preparation of Potassium Sodium Niobate in Silicate Glass System doped with Er_2O_3", Poster presentation, The 2013 JSAP-MRS Joint Symposia (JSAP-MRS), Kyoto, Japan, September 16-20, 2013.

11) P. Yongsiri and K. Pengpat, "Electrical and Optical Properties of Er_2O_3 - Doped Potassium Sodium Niobate-Silicate Glass-ceramics" Poster presentation, The 2nd international conference on advance electromaterials (ICAE), Jeju Island, South Korea, November 12-15, 2013.

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12) P. Yongsiri, S. Sirisoonthorn and K. Pengpat, “Effect of Er2O3 dopant on electrical and optical properties of potassium sodium niobate silicate glass-ceramics” Poster presentation, The 6th international symposium on functional materials (ISFM), Singapore, August 4-7, 2014.

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