Title
Search for crystallographic instability in hexagonal tungsten bronzes

Journal
Physical Review B, 11(10)

ISSN
2469-9950

Authors
Lawson, AC
Fisk, Z
Shanks, HR

Publication Date
1975-05-15

DOI
10.1103/physrevb.11.4054

Search for crystallographic instability in hexagonal tungsten bronzes

A. C. Lawson* and Z. Fisk*
Institute for Pure and Applied Physical Sciences, University of California, San Diego, La Jolla, California 92037

H. R. Shanks
Ames Laboratory USAEC and Department of Physics, Iowa State University, Ames, Iowa 50010
(Received 26 December 1974)

X-ray powder diffraction at 6 °K shows no evidence of crystallographic instability in $K_{0.3}WO_3$ and $Rb_{0.3}WO_3$.

Recent heat-capacity data on $K_{0.3}WO_3$ showed an unexplained anomaly at 20 °K.[1] We have examined two samples of $K_{0.3}WO_3$ and, for comparison, a sample of $Rb_{0.3}WO_3$ by x-ray powder diffraction at 290 and 6 °K. All samples were powders obtained by grinding a large number of crystals which had been prepared by electrolysis.[2] One sample was from a batch used in the heat capacity studies.[1] The powders were attached with vaseline to the cold stage of a liquid-helium-cooled cryostat which served as the sample holder on a G.E. XRD-6 diffractometer. Cu$K\alpha$ radiation was used in conjunction with a diffracted beam monochrometer. Lattice parameter data were accumulated by step scanning.

No evidence for crystallographic instability was found in any of the three samples. The lattice constants obtained in this study are shown in Table I.

If there is any crystallographic transformation in $K_{0.3}WO_3$, these experiments indicate that the accompanying distortion must be very small. Alternatively, there is a possibility that such a transformation could be inhibited by the stresses exerted by the freezing of the vaseline used to attach the powder samples. Such a possibility should be recognized in any future studies of these materials.

TABLE I. Lattice constants, axial ratios, and total thermal expansion for $Rb_{0.3}WO_3$ and $K_{0.3}WO_3$.

	a	$\frac{c}{a}$	$\frac{V_{290}-V_6}{V_{290}}$
$Rb_{0.3}WO_3$			
290 °K	7.387 ± 0.002 Å	1.025	0.012
6 °K	7.363	1.023	
$K_{0.3}WO_3$			
290 °K	7.379	1.020	0.012
6 °K	7.353	1.019	

*Research supported by U. S. Air Force Office of Scientific Research, Air Force Systems Command, USAF, under AFOSR Contract No. AFOSR/F44620-C-0017.

[1] A. J. Bevolo, H. R. Shanks, P. H. Sidles, and G. C. Danielson, Phys. Rev. B 9, 3220 (1974).
[2] H. R. Shanks, J. Cryst. Growth 13/14, 433 (1972).