Acta Cryst. (1961). **14**, 327

On the structure of uranium in thin film.

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(*Received* 28 *July* 1960 *and in revised form* 6 *October* 1960)

A thin film of uranium, obtained by evaporation of a weighed quantity of the metal from a tungsten bucket inside a vacuum chamber (pressure 10^{-4} mm. Hg) on to a collodion film covering a steel wire-mesh, was examined by the electron diffraction method by Chatterjee (1958). He presented a photograph of the electron-diffraction pattern, and stated that it was found to correspond with the tetragonal structure (β phase) of uranium. The estimated and measured ring diameters, Miller indices and visually estimated intensities were given for 12 observed lines in a table. The estimated diameters were apparently calculated by the use of the lattice constants of $a = 10{\cdot}52$, $c = 5{\cdot}57$ Å at room temperature of a uranium–chromium alloy containing 1·4 at.% of Cr reported by Tucker (1951). (The presence of a small amount of Cr in U suppresses the β-U $\rightarrow$ α-U transition, which occurs at 660 °C. in pure U. The lattice constants of the alloy were subsequently determined more accurately by Thewlis (1952), who found $a = 10{\cdot}590$, $c = 5{\cdot}634$ Å, but these small differences do not affect the discussion which follows.)

Table 1. *Diffraction data*

	(1)	(2)	(3)	(4)	(5)
hkl	d_c	d_o	I_o	I	pF^2
311	2·856 Å	2·851 Å	*vf*	> 4	6
410	2·550			70	78
330	2·480	2·503	*f*	53	17
202	2·461			41	14
212	2·397	2·322	*f*	48	36
411	2·320			100	48
331	2·265			58	23
222	2·229			20	8
312	2·135	2·125	*vs*	19	11
620	1·663	1·707	*s*	> 4	1
611	1·652	1·632	*vf*	> 4	> 0·2
{ 522	1·600 }			25	33
{ 621	1·594 }				
{ 532	1·514 }			28	49
{ 631	1·510 }				
413	1·501			45	37
{ 333	1·486 }			40	39
{ 602	1·484 }				

(1) For $a = 10{\cdot}52$, $c = 5{\cdot}57$ Å.
(2) As calculated from the measured diameters given by Chatterjee, with $\lambda = 0{\cdot}0480$ Å. Indices are those assigned by him.
(3) As tabulated by Chatterjee.
(4) Observed relative intensities (uncorrected for absorption or L.-P. factors) from the powder data of Thewlis. All lines out to (10,5,1) having $I > 19$ are included.
(5) ΣpF^2, p the multiplicity, observed F values (corrected for absorption and L.-P. factors) calculated from the single crystal data of Tucker & Senio. Average of (*hkl*) and (*khl*) used when possible.

Table 1 (*cont.*)

	(1)	(2)	(3)	(4)	(5)
hkl	d_c	d_o	I_o	I	pF^2
612	1·469 Å			42	23
720	1·445			37	42
{ 542	1·415 }			21	27
{ 641	1·411 }				
114	1·369	1·357 Å	*vs*	> 4	> 0·1
{ 314	1·285 }			24	41
{ 820	1·276 }				
414	1·222			29	33
424	1·198	1·198	*s*	> 4	0·3
802	1·189			22	15
742, 812	1·182			22	40
434	1·161	1·166	*s*	> 4	0·3
{ 723	1·140 }			20	25
{ 911	1·137 }				
115	1·102	1·105	*vf*	> 4	2
860, (10,0,0)	1·052	1·053	*vf*	> 4	2
{ 932	1·030 }			24	31*
{ 663	1·031 }				
{ 10,1,1	1·029 }				
{ 415	1·021 }			22	23
{ 10,2,1	1·014 }				
724	1·003			36	50
{ 952	0·959 }			25	1*
{ 961	0·958 }				
804	0·956	0·963	*f*	24	0·4
10·5·0	0·941			20	11
10·5·1	0·928			23	5

* Not including the contribution of lines (663) and (961).

Intensity data for uranium powder at 720 °C., and for single crystals of the 1·4 Cr alloy at room temperature have been published by Thewlis (1952) and Tucker & Senio (1953), respectively. Although the data of Chatterjee apparently show fair agreement between observed and calculated spacings, the relative intensities, which are just as important for the identification of a phase, were not used by him. In Table 1 are presented the combined relevant diffraction data of Chatterjee, Thewlis, and Tucker & Senio. It is readily seen that the material which gave the diffraction pattern reported by Chatterjee is *not* β-uranium, nor does it seem to be α-U, γ-U, UO_2, U_3O_8, UC, or UN.

This work was supported by a grant from the National Science Foundation.

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