Lattice Parameter of Beta Titanium at Room Temperature

by B. W. Levinger

THE lattice parameter of the β form of pure titanium has been measured at elevated temperature.[1, 2] No attempt was made, however, to correct the parameter obtained to room temperature.

In the course of phase diagram studies at Armour Research Foundation and elsewhere, the variation of β-phase lattice parameter with composition has been established in a number of binary and ternary systems involving titanium. It was possible to extrapolate in these instances to 100 pct Ti to find the apparent lattice parameter of β titanium at room temperature. Table I lists the results thus obtained. The suggested value for the lattice parameter of β titanium is the average of the extrapolated values 3.276 $\pm$0.003 kX. This suggested value gives an interatomic distance in β titanium of 2.837 kX and

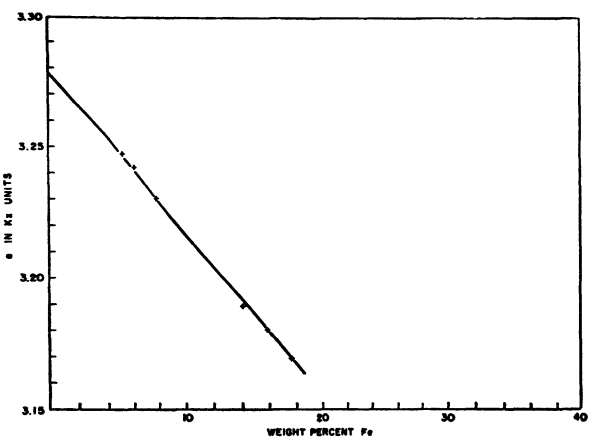

Fig. 1—Lattice parameter vs composition of β phase in binary Ti-Fe alloys.

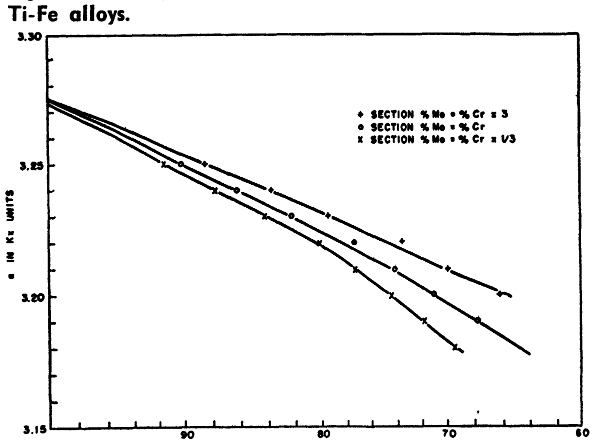

Fig. 2—Lattice parameter vs composition of β phase in ternary Ti-Mo-Cr alloys.

hence a Goldschmidt atomic diameter (coordination number 12) of 2.925 kX. The latter agrees closely with the value of 2.93 given by Hume-Rothery.[3]

From the data of Adenstedt and coworkers[4] it was possible to determine by extrapolation the mean coefficient of linear expansion for β titanium in the range from room temperature to 1000°C. This value, 10.1×10^{-6} per degree C, compares with about 11×10^{-6}

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Table I. Apparent Lattice Parameter of Beta Titanium at Room Temperature

System	Extrapolated β Phase Parameter (kX)	Limit of Stable β Phase Wt Pct Ti	Reference
Ti-V	3.275	85	4
	3.28	85	6
Ti-Cr	3.278	94	7
Ti-Mo	3.276	90	8
Ti-Nb	3.276	64	8
Ti-Fe	3.278	96	9 Fig. 1
Ti-Mo-Cr	3.275		9 Fig. 2
Ti-Mo-Mn	3.277		9 Fig. 3

for α titanium in a similar range.[5] It was thus possible to calculate the parameter at 900°C. The value of 3.305 kX agrees well with 3.3065 given by Eppelsheimer.[2]

The majority of values reported in the literature[1-4, 8] were given as Angstroms. In at least one case, ref. 8, it was shown that they actually represented kX units. The source of this confusion appears to be that a large number of tables of X-ray emission spectra list wavelengths as Angstroms and give values in kX units. The accepted conversion factor for kX

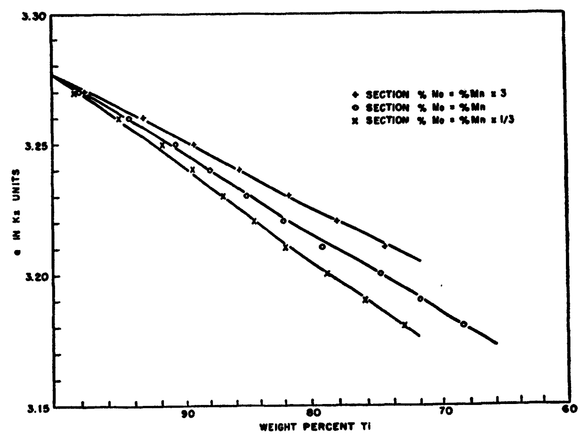

Fig. 3—Lattice parameter vs composition of β phase in ternary Ti-Mo-Mn alloys.

units to Angstroms (10^{-8} cm) is 1.00202. Thus the parameter of β titanium suggested corresponds to 3.282Å.

References

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