quantity. Theoretical approaches support the approximate constancy of $N\langle J^2\rangle$[2,3]. For certain binary transition metal alloys (commonly composed from the central part of the same transition period, but also for Ti-Zr or Nb-Ta, whose constituents belong to the same group of the periodic table) the above concept is in fair agreement with experiment when the value of $N\langle J^2\rangle$ is interpolated linearly between the value for each constituent, according to their concentration[2]. However, this scheme is reported to fail for the V-Nb and V-Ta alloy systems[4].

One notes that the present understanding of superconductivity in transition metals is far from being perfect. It is unlikely to be improved by the usual practice of relying on current knowledge of such complicated parameters as $\langle J^2\rangle$ or $\langle \omega^2\rangle$. Furthermore, nothing is known of what happens to these quantities when different elements combine to form an alloy, even if the lattice type remains the same (bcc). It thus appears more realistic to consider the electronic density of states again as the dominate parameter affecting T_c. Alloying alone does not provide adequate information. Further knowledge can be obtained by varying the volume by application of high pressure. This is regarded as a relatively simple external agent, especially in crystals with cubic symmetry and one infers that the superconductor's response can be easily interpreted[5].

In two earlier papers[6,7] high pressure studies had been reported on the bcc part of the $4d$-alloy systems Zr-Nb and Nb-Mo. From these data a simple empirical relation was established for pressures in excess of 20 kbar:

$$\frac{\partial g}{\partial p} = a\,\frac{\partial g}{\partial n} \tag{1}$$

where p is the pressure, n is the number of valence electrons per atom as derived from the composition, and a is a constant. It follows from Eq. (1) that over the whole range of composition ($4.4 < n < 5.27$) the quantity g can be changed by the same amount by either applying a pressure Δp or adding $\Delta n = a \cdot \Delta p$ electrons per atom.

4 Ishikawa, M., Toth, L. M.: Phys. Rev. B3, 1856 (1971). — Corsan, J. M., Cook, A. J.: Phys. stat. sol. 40, 657 (1970).
5 In the case of *non* transition elements a rather conclusive argument for the governing role of the phonon term on the transition temperature is derived from systematic pressure studies. (Olsen, J. L., Andres, K., Geballe, T. H.: Phys. Lett. 26A, 239 (1968). — Gey, W.: Vorträge zur Sommerschule über Supraleitung. Steibis, 1969).
6 Gey, W., Köhnlein, D.: Phys. Lett. 29A, 450 (1969).
7 Gey, W.: Z. Physik 229, 85 (1969). — Essentially identical results for dT_c/dp of Zr-Nb-Mo-alloys have later been reported by Smith, T. F.: AIP Conf. Proc./4, Amer. Institute of Physics, editor D. H. Douglass, p. 293. New York 1972.

To determine whether the simple correlation given in Eq. (1) is of a more general validity, we have extended investigations of the effect of pressure on T_c to the bcc alloys of the 5-d transition series Hf-Ta and Ta-W. We find Eq. (1) obeyed.

Experimental

Experimental procedure and sample preparation were the same as reported in Ref.[7]. The starting materials were: Ta, 99.9% sheet, Koch-light Labs; W, 99.9% powder, Koch-Light Labs; Hf, 99.8% powder, Leyless Metal and Chemical Corp. Since Hf and W dissolve rather slowly in Ta, the ingots were remelted 12 to 15 times and turned over in the copper hearth of the electron beam furnace until homogeneity was obtained, as checked by x-ray diffraction. Due to this preparation excessive weight losses of up to 9% occured for some of the Hf-Ta samples. Deviations from the nominal composition were accounted for by measuring the lattice constants and interpolating linearly between samples with no weight loss and pure tantalum, respectively. The maximum error in determining n this way was $\pm 0.4\%$. X-ray data showed no traces of phases other than the β-phase (bcc).

Results

To our knowledge no information on $T_c(n)$ exists in the literature for Hf-Ta alloys, except for $n=4.7$ [8]. Also data on Ta-W alloys are scarce [8].

Table 1

Alloy	n	T_c(K)	a (Å)	$\partial \ln T_c/\partial p_{p>10\text{ kbar}}$ (10^{-6} bar^{-1})
$Hf_{61}Ta_{39}$	4.39	5.71		$+0.88$
$Hf_{52}Ta_{48}$	4.48	6.61		$+0.78$
$Hf_{40}Ta_{60}$	4.60	6.85	3.591	$+0.57$
$(Hf_{30}Ta_{70}$	4.70	6.8	3.573)[8]	—
$Hf_{20}Ta_{80}$	4.80	6.90	3.341	$+0.36$
$Hf_{10}Ta_{90}$	4.90	5.60		-0.27
Ta	5.00	4.21	3.298	-0.62
$Ta_{96}W_4$	5.04	3.30		-0.57
$Ta_{91}W_9$	5.09	2.78		-0.80
$Ta_{84}W_{16}$	5.16	1.86		-1.10
$Ta_{78}W_{22}$	5.22	1.36		-1.2

Lattice constants a are only given for those Hf-Ta alloys which were not subject to weight losses during preparation. The approximate error for T_c is $\pm 1\%$, for $\partial \ln T_c/\partial p$ it varies from 3 to 5%.

8 Bucher, E. F., Heiniger, F., Muller, J.: Proc. LT9, p. 1059. New York: Plenum Press, Inc., 1965.