upon the temperature. The maximum temperature used was 1700° C (for 1 h), when the crucible appeared to be perfectly satisfactory.

This technique can, of course, be used for any materials with a suitable phase diagram, i.e. with substantially different melting points and which form solid solutions of interest. A minimum is not essential. For single crystal growth, a simple liquid-to-solid boundary in the diagram can be desirable.

Acknowledgements

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Quantitative Size-Factors for Gold-Manganese Solid Solutions

King [1] has shown the need to have an accurate knowledge of the quantitative size-factors involved in alloy systems.

Lattice parameters have been measured, at 18° C, for a number of Au-Mn alloys. The alloys were prepared by melting together, in an evacuated silica phial, accurately weighed amounts of assay Au wire and 99.99 % pure Mn, supplied by Johnson, Matthey and Co Ltd. Each ingot was homogenised for approximately 100 h at 950° C, to remove any coring which might have occurred in the initial rapid cooling from the molten state. The final weight of an alloy was checked against the initial weight of pure metals used, and in no case was the loss in weight greater than 0.05 %. To check the degree of homogeneity, lattice parameters were determined from filings taken from each end of the ingots. For any one alloy, the lattice parameters were required to agree to within 0.0002 Å.

Filings, from each alloy, were annealed, in vacuo, for 100 h at 400° C, and then quenched in cold water. Lattice parameters, of these filings, were determined by the Debye-Scherrer technique using X-rays emitted from a copper target. The X-ray camera had a diameter of 11.483 cm, with the film mounted in the Straumanis manner. The X-ray wavelengths assumed were: $CuK\alpha_1$, 1.54050; $CuK\alpha_2$, 1.54434 Å. The results are listed in table I.

Linear extrapolation of these figures gives the effective atomic volume for Mn as 16.03 Å^3.

TABLE I

Composition (at. % Mn)	Lattice parameter (Å)	Atomic volume (Å^3)
00.0	4.0781	16.956
3.7	4.0759	16.927
12.3	4.0686	16.840
15.8	4.0667	16.815
17.9	4.0649	16.793
18.9	4.0636	16.776

The volume size-factor, for the Au-Mn system, is thus −5.46 %, the linear size-factor is −1.86 %, and the Vegard's law factor is 31.29 %. These values are in general agreement with the earlier results quoted by King [1].

The lattice parameter/temperature curve for a β-phase alloy, containing 49.75 at. % Mn, shows a cubic/tetragonal transformation at 125° C [2]. Extrapolation of the cubic lattice parameters down to 18° C gives a parameter of 3.208 Å for the ordered bcc lattice, indicating, a value of 16.50 Å^3 for the atomic volume. This point lies on the linear curve of atomic volume/composition as determined for the α-phase alloys (fig. 1). Such a result is in agreement with the general findings for β-intermediate phases in alloys of Cu, Ag, and Au [3, 4].

The behaviour of this alloy appears to confirm the theory of Warlimont [5], which suggests that, when the volume size-factor is less than 20 %, the ordered cubic lattice decomposes martensitically at lower temperatures. Later work [6] has shown that the temperature at

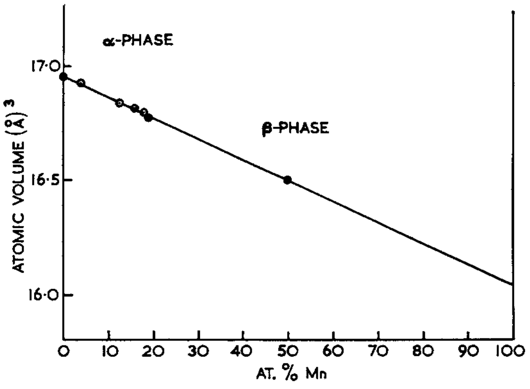

Figure 1

which this martensitic transformation takes place can be varied systematically, by replacing some of the Mn atoms with slightly larger atoms, such as those of Al, thus varying the volume size-factor.

Work is at present in progress to investigate the way in which this control of crystal structure can be used to produce desired magnetic properties in these ternary alloys.

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*Piezo-optic Behaviour of Rubidium Chloride up to the Phase Transition Point**

Single crystals of RbCl were grown by the Bridgman method from chemically pure† (99.9%) materials obtained from A. D. Mackay & Co‡, and were cleaved, ground and polished to about 8 × 6 × 3 mm size, such that localised interference fringes of the Newtonian type were visible. The samples were then coated with a thin layer of aluminium by evaporation, to increase the contrast of the fringes. With the use of an optical high pressure bomb and the experimental arrangement described elsewhere [1, 2], the variation of the refractive index of RbCl with pressure was determined from the shift of the interference fringes. For the computation of the thickness change the second-order elastic constants data of Haussuhl [3] were used in conjunction with the third-order elastic constants theoretically evaluated by Ghate [4]. It is believed that the use of Ghate's theoretical values is justifiable, in view of the good agreement of his similar theoretical values for NaCl and KCl with the experimentally determined values of Chang [5], and also from the consistency of our own results.

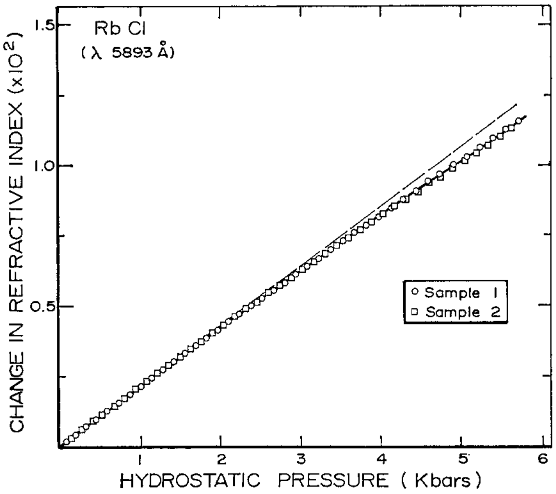

Figure 1 Variation of refractive index of RbCl with pressure; $T = 22°$ C.

Fig. 1 represents the variation of the refractive index Δn as a function of hydrostatic pressure. Considering that the error involved in the measurement of Δn is only 2 to 3 in the third figure, it is seen that above 3 kbars a distinct departure from linearity is noticed. However, the plot of Δn as a function of the volume strain $\Delta V/V_0$, computed from the Lagrangian strain η from $\Delta V/V_0 = 3\eta\,(1 + \frac{1}{2}\eta)$, gives a linear relation in the entire range in-

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† Impurities detected by spectrochemical analysis: K, 0.05 to 0.1%; Cs, 0.05 to 0.1%; Na, 5 to 20 ppm; Fe, 10 to 50 ppm; Ca, 2 to 10 ppm; Li < 100 ppm.

‡ 198 Broadway, New York 38, N.Y.