Fig. 3. Isothermal ageing Al–Zn–Mg–Cu alloy

zone structure once established is particularly stable and persists even during ageing at 160° C. and higher. The experimental evidence suggests that ideally the zone structure would not develop at ageing temperatures above 110° C., but in practice does so during heating to the ageing temperature (heating time less than 1 min.). For ageing temperatures of 110° C. and above the resistivity changes and mechanical properties of this alloy are significantly affected by the rate of heating to temperature, both peak hardness and peak resistivity being increased by slow heating.

For these higher ageing temperatures the resistivity peak is closely associated with the primary hardness increase, and it is reasonable to suppose that the resistivity effect is more closely associated with high coherency strains rather than with the existence of zones of critical dimensions. Thomas and Nutting[6] estimate that the zone diameter in this quaternary material is of the order of 80 Å.

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Purification of Metals by Gas Chromatography

THE use of chromatographic techniques for the separation of an alloy into its constituent elements or for the direct purification of metallic elements has not, to our knowledge, been reported. In order to test the feasibility of the separation a zinc–cadmium (8·4 per cent zinc) alloy was used. The advantages of this alloy system for this test are : (1) both elements have significant vapour pressures at temperatures which do not pose extremely difficult material problems ; (2) they are chemically similar ; (3) they are common metals ; (4) their reactivity is small enough so that they pose no handling problems (as would the alkali metals).

The containing tube was a 50-cm. length of 13-mm. 'Vycor'. The stationary phase, lithium chloride, was supported as a film on sea sand (20 per cent lithium chloride, 80 per cent fine sea sand). The temperature was high enough so that the lithium chloride melted and formed a film on the sand. The eluting gas, purified helium, had a velocity of 150 ml./min. and was preheated to 620° C., the bed temperature. The 0·1-gm. sample of alloy was laid on top of the bed before heating. It was necessary to eliminate most of the oxygen and water from the system in order to minimize oxidation of the sample. The emerging metal vapours were caught on glass cold fingers held in the gas stream for a short time. The metal was dissolved in distilled nitric acid and analysed spectrographically.

It was shown that the cadmium content of the vapour was more than 200 times the zinc content. The amount of zinc present was near the lower limit of the analytical procedure. It was also shown, by duplicating the above experiment without the stationary or solid phases, that the process was not that of simple distillation. In this case the zinc deposit was equal to, or greater than, the cadmium deposit. Although neither of the constituents was collected quantitatively, these experiments suggest that metals can be efficiently separated.

I wish to acknowledge the assistance of Messrs. S. Greenberg and C. A. Youngdahl. This work was done under the auspices of the U.S. Atomic Energy Commission.

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CHEMISTRY

Decomposition of Uranium Dioxide at its Melting Point

WE have found that fusion of uranium dioxide in an argon arc furnace at $2,800 \pm 100°$ C., between a tungsten cathode and a water-cooled copper anode, consistently gave lustrous grey metallic-looking products, with the gross analytical composition UO_{2-x} $(0·15 > r > 0)$. The fused material was contaminated with less than 0·001 per cent of copper or tungsten. The extent to which the product was deficient in oxygen depended upon how long the sample had been held in the molten state, but the liquid seemed to approach a limiting composition, about $UO_{1·86}$, after prolonged fusion. There was some vaporization from the melt, but the constitution of the vapour phase is unknown ; after exposure to air, the powdery sublimate present in the furnace consisted of the oxygen-excess phase UO_{2+x}.

The massive fused material was quite stable in air, but when it was powdered it readily combined with oxygen, up to a composition around $UO_{2·005}$. X-ray analysis of a fine chip of the fused product revealed the presence of two phases.

(A) The major phase (estimated 94–98 mole per cent) was face centred cubic with $a_0 = 5·4718 \pm 0·0004$ Å., which may be compared with the fluorite cell of essentially stoichiometric uranium dioxide, $UO_{1·999} \pm 0·001$, with $a_0 = 5·4700 \pm 0·0004$ Å.

This small but significant expansion of the uranium dioxide lattice, which has also been observed when uranium metal and uranium dioxide are heated above 2,000° C. in a graphite resistance furnace[1], is taken to