

It is intended to publish elsewhere a more detailed account of the production and use of the gratings.

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¹ *Nature*, **154**, 69 (1944).

² Robertson, *Proc. Roy. Soc., A*, **142**, 659 (1933).

Striated Structure of Age-hardened Alloys

Drs. Guinier and Jacquet¹ have referred to striated structures appearing in polished specimens, etched or unetched, in the earlier stages of the age-hardening of certain alloys and in particular of aluminium-copper and copper-beryllium alloys.

With regard to aluminium-copper alloys, an extensive research into the mechanism of ageing of high-purity 4 per cent copper-aluminium alloy has confirmed the view I put forward in 1940², that these 'striations' could be attributed to accelerated ageing resulting from plastic deformation on quenching, and has again led me to the conclusion that they are not a necessary accompaniment of the age-hardening process. The results I have obtained also show that the lattice-strains, set up in the early stages of ageing by the formation of the Guinier-Preston plates, are relieved when the latter attain a critical size by the precipitation of sub-microscopic copper-rich aggregates and sub-microscopic crystallites of the aluminium solid solution stable at the temperature of ageing. The beginning of the 'flat' on time-hardness curves marks the appearance of this process. As ageing proceeds, these copper-rich segregates and crystallites of aluminium become microscopic in size, as shown in Fig. *a*, which is a photomicrograph of the etched structure of high purity 4 per cent copper-aluminium alloy, quenched and aged 80 days at 130° C. White crystallites of aluminium solid solution, stable at 130° C., are seen in the grain boundaries and in the matrix, together with the black areas which are indicative of copper-rich regions.

Furthermore, Wassermann's³ suggestion that striated structures may be attributed to mechanical twinning resulting from quenching stresses is not confirmed. Fig. *b* is the photomicrograph of part of a large grain of high-purity 4 per cent copper-aluminium alloy, in which several 'striations' were revealed on

etching the quenched and aged specimen. The specific etching reagent has developed the crystallites of the aluminium solid solution, stable at the ageing temperature, as referred to above. The 'striations' are composed of many of these crystallites, and it is clear that where the two bands of striae cross one another, no change in direction occurs. My researches into the relationship between cold-work and age-hardening show that cold-working (strain-hardening) and age-hardening are similar processes, and that when the lattice has been strained to a critical amount, relief occurs by the formation of crystallites of aluminium along the planes of slip, resulting in accelerated ageing. Hence the crystallites shown in Fig. *b* are due to accelerated ageing in strained areas.

If quenching is very severe, as it was in the case of the specimen mentioned above, 'striations' are formed; it is probable, however, that they are deformation bands of the type found by Barrett and Levenson⁴ in compressed aluminium. The spontaneous development of striations in copper-beryllium alloys is, I think, a different phenomenon; rather they are associated with the development of internal strains in the lattice due to the formation of beryllium-rich zones, as postulated by Guinier and Jacquet, and not to plastic deformation. The relief of strains set up takes place in these alloys on a macro-scale, that is, with the formation of striations similar in type to Lüder's lines; in the case of copper-aluminium alloys, the relief of strain in the early stages is on a sub-microscopic scale and is not accompanied by 'striations'.

In the near future I hope to publish full details in support of my statements.

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¹ *Nature*, **155**, 695 (1945).

² Gayler, M. L. V., and Parkhouse, R., *J. Inst. Met.*, **66**, 67 (1940).

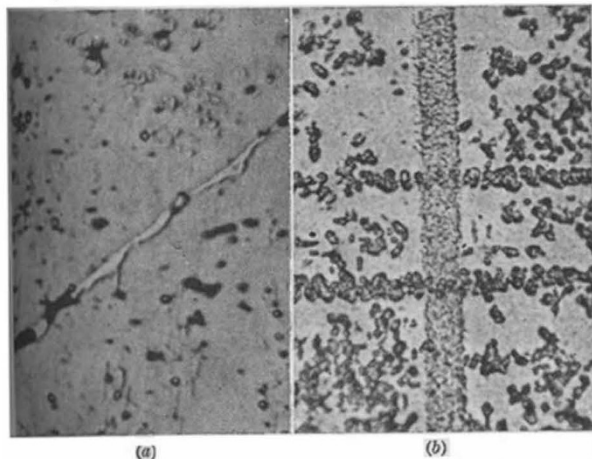
³ Wassermann, G., *Z. Metallkunde*, **30**, 62 (1938).

⁴ Barrett, C. S., and Levenson, L. H., *Amer. Inst. Min. Met. Eng., Inst. Met. Div.*, **137**, 112 (1940).

Fluorescence of Dipropyl Ketone at Low Temperatures

It is well known that fluorescence bands sometimes undergo changes in position and intensity with the change of state and temperature of the substance, and also they sometimes show some structure at low temperatures. Organic substances which do not exhibit any fluorescence at room temperature but show intense fluorescence bands at low temperatures are, however, very rare.

While investigating the Raman spectra of organic substances at low temperatures, we have observed that dipropyl ketone is one such substance. When it is irradiated in the solid state at about -170° C. by light from mercury arcs condensed by thick glass condensers, it yields a feeble Raman spectrum containing also a very intense fluorescence band extending from λ 4880 up to λ 5100, the short wave-length edge of the band being less diffuse than the long wave-length edge. The Raman spectrum of the liquid at room temperature observed under similar conditions does not show any appreciable fluorescence in the visible region, as can be seen from the spectrum reproduced; the spectrogram for the solid at about



4% COPPER-ALUMINIUM (a) AGED 80 DAYS, 130° C.; \times 2,000;
(b) AGED 4 HR., 190° C.; \times 1,500.