

tion time, whereas the acoustic value is associated with molecular deformation. The existence of two relaxation times has already been suggested by Kuhn *et al.*<sup>11</sup> and by Cerf<sup>12</sup>.

Measurements to be reported later have been made on polyvinyl chloride and cellulose acetate in cyclohexanone.

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### Electron Distribution and Characteristic Temperature Variation at Low Temperatures in Magnesium and Ruthenium

A NUMBER of X-ray investigations on metals have indicated that over and above a uniform background of electron distribution, there exists electron density concentration at particular sites in the lattice. Brindley and Ridley<sup>1</sup> attributed the deviations of the measured X-ray scattering factors of ruthenium from a smooth curve to the existence of electron concentration at the mid-point of all the basal triangles formed by ruthenium atoms. Brill *et al.*<sup>2,3</sup> discussed for magnesium a similar concentration at only those triangle mid-points which are surrounded by five magnesium atoms. A similar effect, enhanced at 90° K., was found by Griffith and Harris<sup>4</sup> in lithium. Ageev *et al.*<sup>5,6</sup> interpreted their results on copper and nickel on the basis of bridge electrons corresponding to covalent bonds. On the other hand, other investigations on aluminium, silver, copper, nickel, chromium, etc., do not support the concentration of electron density. Theoretically, it is known that high-temperature factors used to eliminate the termination effect in Fourier series or errors in Fourier coefficients can lead to secondary maxima which could be interpreted as electron concentrations or bridge electrons.

If the concentration of electron density at lattice points not occupied by atoms is a real effect, then one can consider it as an extra scattering centre which modifies the scattering from atoms of the unit cell<sup>7</sup>. It effects the scattering factors of low-angle reflexions to show systematic deviations from a smooth curve. Deviations in the intensity of low-angle reflexions from theoretical values of about 5 per cent in magnesium and 12 per cent in ruthenium are expected on the basis of the above-mentioned observations<sup>1-4</sup>. To verify this effect, accurate measurements of scattering factors of magnesium and ruthenium at 296° K., 90° K. and 5° K. have been made by means of a scintillation counter. The scattering factor curves of both metals have been found to be smooth and do not show the expected systematic deviations. Therefore, no evidence has been found

to support the hypothesis of the existence of electron density maxima in magnesium and ruthenium lattices at points other than those occupied by atoms.

The characteristic temperature has been calculated from the measured scattering factors. For magnesium, the values of characteristic temperature are found to be 315° K., 320° K. and 375° K. at temperatures of 296° K., 90° K. and 5° K., respectively. For ruthenium, at the same temperatures, values are found to be 350° K., 350° K. and 390° K. respectively. The value of 390° K. for ruthenium at 5° K. is rather uncertain in view of the smallness of the temperature factor. In any case, both hexagonal metals show an increase in the characteristic temperature at low temperature. A similar rise has been found from specific heat measurements on various hexagonal metals<sup>8</sup>. The latest specific heat measurements<sup>9</sup> of magnesium give characteristic temperatures of 326° K., 326° K., 389° K., 406° K., at temperatures of 296° K., 90° K., 10° K., 0° K. (extrapolated), respectively. The elastic constants data<sup>10</sup> of magnesium if extrapolated yield at 0° K. a value of 388° K. for the characteristic temperature. This rise in the characteristic temperature is not expected on the basis of Debye's simplified continuum theory but it can be explained by means of a detailed lattice theory.

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## CHEMISTRY

### Magnetic Susceptibility Measurements of Iron (III) Form Ion Exchange Resin

It has been known for some time that the quantity of a trivalent metal sorbed on an ion exchange resin, in equilibrium with a solution of a salt of the same metal, varies, *inter alia*, with the pH value of the solution. In the case of indium (III)<sup>1</sup> and iron (III)<sup>2</sup> salt solutions it has been suggested that differences in uptake from the expected 0.333 gm. ion per equivalent of resin are caused by the presence in the solution of hydrolysis products.

According to Mulay and Selwood<sup>3</sup>, the hydrolysed iron species  $Fe_2(OH)_2^{4+}$ , suggested by Hedstrom<sup>4</sup> and others, is diamagnetic and this fact has been used by Mulay and Selwood<sup>3</sup> to interpret the results obtained in investigations on the hydrolysis of iron (III).

For the present work, samples of cation exchange resin in the iron (III) form were prepared by equilibrating portions of the resin with solutions of ferric chloride having varying values of pH, and the magnetic moment of the iron sorbed on to the resin has been measured.