

Oxide Film of Alloys containing Small Percentages of Aluminium

WHEN copper alloys containing more than 2 per cent aluminium were heated for many hours at a red heat (800°-900° C), no oxide scales were formed. In cases where several per cent of this element was added, the alloys even retained their characteristic golden yellow lustre, which is a very remarkable fact. Elements such as tin, zinc, nickel, manganese, magnesium, iron, etc., when added to copper do not produce this effect.

The oxidised surfaces were studied by means of cathode ray reflection. Copper surfaces exposed at a red heat gave the CuO pattern. (At lower temperatures, the Cu₂O and a three ring pattern were also observed, as first pointed out by G. P. Thomson and C. A. Murison¹.)

Upon heating alloys containing several per cent of aluminium at a red heat with a Bunsen burner, the surface in contact with air was blackened and gave the CuO pattern, while the surface imbedded in the oxidising flame remained bright and gave a pattern corresponding to that of pure γ -Al₂O₃. No diminution of the lustre of the latter surface was observable after continued heating.

The fact that alloys, containing only about 10 atomic per cent of aluminium, when heated with an insufficient supply of oxygen, become covered with a film of pure Al₂O₃ seems rather striking; because some copper oxide was anticipated. In the case where heating was done in air or in oxygen, the uppermost surface probably becomes covered with an extremely thin film of copper oxide, but beneath this layer, since oxygen is wanting, an Al₂O₃ film might be formed, and this in turn probably protects the inner part from further oxidation. Inasmuch as such a film is colourless, the alloy does not lose its golden lustre, even after prolonged exposure to red heat. The same may be true of iron alloys.

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¹ G. P. Thomson, *Proc. Roy. Soc., A*, **128**, 649; 1930. C. A. Murison, *Phil. Mag.*, **17**, 96; 1934.

Iridium Isotopes and their Nuclear Spin

AN examination of the hyperfine structure of the arc lines of iridium $\lambda\lambda 3800\cdot 10$, $3513\cdot 67$ and $2924\cdot 81$ A. radiated from a modified form of hollow cathode reveals that the three lines having a common lower level in the ground term $5d^8 6s^4 F_{4\frac{1}{2}}^1$ are identical in structure. The hyperfine components are therefore ascribed to a spin splitting of the ground term with the upper levels unsplit. $\lambda 3513\cdot 67$ A. ($5d^8 6s^4 F_{4\frac{1}{2}}^1 - 5d^8 6p^4 G_{4\frac{1}{2}}^0$) exhibits the following structure:

$\Delta\nu$ in cm. ⁻¹	(Int.)	Remarks
+ 0.072	(7)	This component is diffuse and appears almost as a continuous patch between + 0.072 and 0.000, indicating the presence of an expected satellite at + 0.033 (9). (vide Fig. 1.)
0.000	(22)	
- 0.073	(13)	
- 0.145	(9)	

The observed structure is accounted for uniquely by assuming two isotopes of masses 191 and 193 with nuclear spins of $\frac{1}{2}$ and $\frac{3}{2}$ respectively. The ratio of the magnetic moments of the two nuclei is nearly -1.0. The isotope displacement in $5d^8 6s^4 F_{4\frac{1}{2}}^1$ is 0.057 cm.⁻¹, with the heavier isotope lying deeper, as

in the arc lines of copper and thallium.² The incompletely resolved patterns of some other Ir I lines $\lambda\lambda 3220\cdot 79$, $2694\cdot 22$, $2664\cdot 77$ and $2639\cdot 70$ A. support the above conclusions. The existence of isotope shift favours the suggestion that the ground term is a $^4F_{4\frac{1}{2}}^1$ term arising from an electron configuration $5s^2 5p^6 5d^8 6s$ in preference to a $^2D_{3/2}$ term from $5s^2 5p^6 5d^9$.³

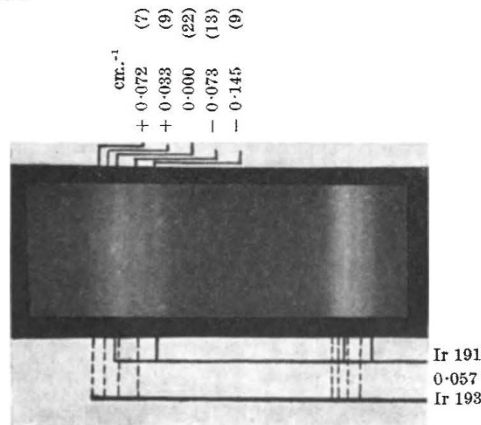


FIG. 1. Structure pattern of Ir I, 3513.67 A. obtained with a Hilger quartz Lummer plate, 3.45 mm. thick, 20 cm. long.

Iridium is one of the few elements the isotopic constitution of which has not so far been revealed by the mass-spectrograph. Judging from a visual estimate of the intensities of the components, the relative abundance of the isotopes 191 and 193 is 1 : 2, giving a value, perhaps a little too low, of 192.4 for the atomic weight of iridium. It appears, however, that the atomic weight of the iridium must be less than 193; there is considerable disagreement in the values of atomic weight given by several investigators, which range from 192.59 to 193.40. The existence of a heavier isotope like 195 is ruled out by the fact that usually there is no isobare in appreciable quantity for an isotope of an element with odd atomic number; and platinum has been previously shown to contain the isotope Pt 195 to the extent of nearly 30 per cent.⁴

Details will appear in the *Proceedings of the Indian Academy of Sciences*.

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¹ Albertson, *Phys. Rev.*, **42**, 443; 1932.
² Venkatesachar and Sibaiya, *Proc. Ind. Acad. Sci.*, **1**, 13; 1934.
³ Meggers and Laporte, *Phys. Rev.*, **23**, 660; 1926.
⁴ Venkatesachar and Sibaiya, *NATURE*, **136**, 65; 1935. *Proc. Ind. Acad. Sci.*, **1**, 955; 1935. *ibid.*, **2**, 101; 1935.

K-Series of Magnesium and Sodium

I HAVE already published¹ some results obtained in the region of long wave-lengths with the ionic tube designed and constructed by me with Prof. Dolejšek². With this ionic tube and with a new focusing method, the principle of which will be described elsewhere, I have obtained some new results which show the great efficacy of our apparatus for long wave-lengths of X-spectra.

As an example of what can be obtained by our

ionic tube, I should like to point out in this connexion that with the ionic tube alone, using the normal Bragg method, I obtained the new non-diagram lines in the K -series of Mg and Al which were recently found by Prof. M. Siegbahn and H. Karlsson³ using new focusing methods, which they have worked out. By our new focusing method and with this ionic tube I have obtained in the spectrum of Mg all these lines, and especially when nitrogen is let into this tube, I have further got, as can be

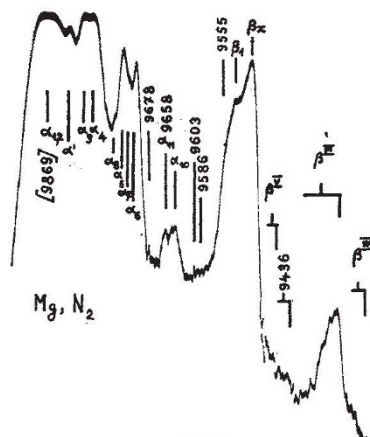


FIG. 1.

seen from the microphotometric curve (Fig. 1), the lines in the α -group as well as those in the β -group, which have not hitherto been observed.

In the emission spectrum of MgO, when oxygen is let into our ionic tube, there are certain changes; for example, in the α -group the lines 9603 and 9586 X. do not occur and $\alpha_{10,11}$ appear as a single broad band, and changes analogous to these also occur in the lines of β -group. I have found similar characteristic qualities in the spectrum of sodium

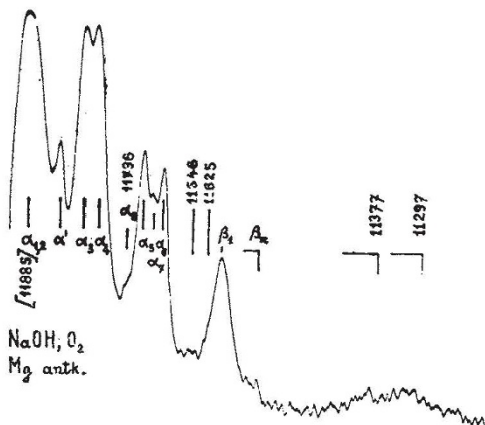


FIG. 2.

oxide. The microphotometrical curve of the spectrum of sodium (NaOH on the magnesium anticathode) is reproduced in Fig. 2. In these curves the lines which were hitherto neither known nor measured are indicated with their wave-lengths.

Both spectra were obtained using an effective tension of 2,000 v. and 200 ma. in the case of Mg, and 1,500 v. and 200 ma. in the case of Na, thus avoiding the occurrence of lines of higher orders.

As in the above investigation on the emission spectra of the K -series, I have tried to find the white absorp-

tion lines, which I have obtained while studying the M -series with the ionic tube and without the use of the focusing method. In the place where I formerly found two white lines and classified them as M_{II} absorption of Ta, I have now got these white lines and also obtained a complicated structure. But this absorption effect, classified by me as M_{II} absorption of Ta⁴, must be classified as the absorption structure of sulphur from the crystal, which has not been observed until now. In the place where I formerly obtained the white line and classified it as M_I absorption of W, I have now again got the same line, and at present from our results it is not possible to find any other classification for it. It is necessary, however, to reinvestigate this identification since the results for both elements do not agree. This will be possible after obtaining more experimental data.

The examples mentioned of the results in the K -series and the absorption of sulphur show that our ionic tube, in connexion with any focusing method, gives further possibilities in the region of long wave-lengths.

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¹ V. Kunzl, NATURE, 132, 139; 1933. *Acta Phys. Polonica*, 2, 447; 1934.

² V. Dolejšek and V. Kunzl, *Z. Phys.*, 74, 565; 1932.

³ M. Siegbahn and H. Karlsson, NATURE, 132, 895; 1933. *Z. Phys.*, 83, 76; 1934.

⁴ V. Kunzl, l.c.

Action of Benzylcarbonyl Chloride on Insulin and Other Proteins

IN previous investigations, the reaction between phenyl isocyanate and proteins has been used to study the immunological properties of protein antigens¹. In other investigations², it was found that insulin is readily inactivated by phenyl- and *p*-bromophenyl isocyanates, and from the information derived from the earlier work, the conclusion was reached that this inactivation is due to a reaction between the isocyanate and the free amino-groups of the insulin. Jensen and Evans simultaneously investigated this inactivation of insulin³, and reached somewhat similar conclusions.

Recently, we have been studying the action on proteins of benzylcarbonyl chloride ($C_6H_5.CH_2.O.CO.Cl$), the reagent used with such success by Bergmann and his co-workers⁴. These chemical and immunological investigations are not yet complete, but sufficient evidence is available to show that this reagent reacts quite readily with native proteins, just as it does with the free amino-groups of amino-acids and simple peptides. This reaction, like that between phenyl isocyanate and proteins, is quite mild, and proceeds smoothly at about pH 8 and 5° C. As the reaction continues, there is a marked diminution in the free amino-nitrogen of the protein, and in many cases, the product (benzylcarbonato-protein) contains practically no free amino-nitrogen. On injection into rabbits, the benzylcarbonato derivative of serum globulin produces antibodies which, from precipitin and inhibition tests, appear to be specific for the new grouping in the protein (the benzylcarbonato-amino acid group).

In the course of chemical and immunological investigations on insulin, the physiological activity of benzylcarbonato-insulin has been studied, and it has been found that this derivative has no significant