Letters to the Editor

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Selective Transmission of γ-Radiation by Lead

SEVERAL workers have recorded an apparent anomaly in the γ-ray absorption of lead. Investigations carried out in this laboratory seem to throw new light on the phenomenon.

The mode of attack consisted in the continuous comparison of the γ-ray transmission through pairs of screens, lead and bismuth, lead and thallium, lead and copper, etc., when using as the source of radiation the ageing active deposit obtained in freshly filled radon

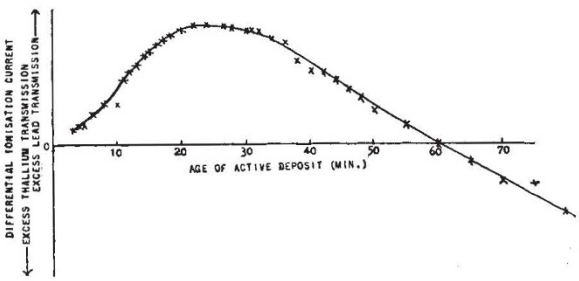

FIG. 1.—Selective γ-ray transmission from radium B through lead as compared with thallium. Source—80 m.c. radon. Screens—0·3 m.m. lead and 0·3 m.m. thallium.

containers. Comparisons carried out before the attainment of the transient equilibrium between radium *B* and *C* show that the transmission ratios Pb/Bi Pb/Tl gradually increase to a maximum and then decrease. An uncorrected set of readings obtained when using a method in which the differential ionisation currents were measured is shown in Fig. 1.

It would appear from these experiments that *a substance is selectively transparent to some at least of the radiations emitted by its radioactive isotope.* A more detailed account of the method of observation and the results obtained will be published in another place.

F. L. HOPWOOD.
T. E. BANKS.
T. A. CHALMERS.

Physics Department,
St. Bartholomew's Hospital,
Medical College, E.C.1,
Sept. 3.

Magnetic Moment and the Chemical Bond in Alloys

FORRER,[1] Sadron,[2] and Néel [3] have recently published several articles in which they compute the elementary moments of different substances at small concentrations in nickel alloys. Their empirical results are interesting, but their theoretical conclusions cannot be brought into agreement with modern views on atomic structure.

The empirical material may be re-interpreted on the basis of the following assumptions: 1. According to Stoner,[4] pure nickel consists, at low temperatures, of 40 per cent neutral atoms with zero moment and 60 per cent singly ionised atoms with a moment equal to 1 Bohr magneton (M_B). 2. Every foreign atom entering the nickel lattice becomes singly ionised. 3. The number of ionised atoms in the alloy at low temperatures, with small concentrations of foreign metals, is related to the number of neutral atoms in the same way as in pure nickel. 4. Contrary to my previous view, the conduction electrons do not play any important rôle in ferromagnetism.

With these assumptions, the following values for the effective magnetic moments per atom may be calculated from Sadron's data:

$$Ni^{+}1 \quad Cu^{+}0 \quad Zn^{+}-1 \quad Al^{+}-2 \quad Sn^{+}-3 \quad (M_B).$$

The negative values of the moments of Zn^{+}, Al^{+}, and Sn^{+} correspond precisely to the number of valence electrons left attached to the corresponding ion. This remarkable fact may be interpreted as follows: The positive 1 M_B moment in nickel is produced by one 'missing' electron in the incomplete 3*d* shell, as pointed out by Stoner; while the negative moments are produced by 'superfluous' electrons of the corresponding ions. This leads to the conclusion that the secondary valences are compensated by mutual atomic linkage; so that a Zn^{+} ion destroys one elementary magnet (equal to 1 M_B) in Ni^{+}, an Al^{+} ion destroys the magnetism of two Ni^{+} ions, and a Sn^{+} ion of three. This interpretation enables us to understand why a Pd^{+} ion, which possesses a missing electron, a 'hole', in the 4*d* shell, plays the rôle of a ferromagnetic in nickel, with the same moment as nickel itself. A study of the nickel-iron and nickel-cobalt alloys shows that iron inside nickel has $3M_B$, due to 3 missing electrons, and cobalt $2M_B$, due to 2 missing electrons in the 3*d* shell. The same ionic states are found from susceptibility measurements above the Curie point as from magnetic saturation values at low temperatures. This is shown in the following table:

Metal.	Electronic State of Singly Ionised Atom.	Magnetic Moment from Saturation Value (M_B).		Magnetic Moment from Susceptibility (Weiss units).[5]	
		Calc.	Obs.	Calc.	Obs.
Fe	d^7	3	3·2	22–26	20–22
Co	d^8	2	1·8	14·5–17	15
Ni	d^9	1	1	9–11	8–9

These results seem to open up a new approach to the problems of the chemical bond in metals and of the inner structure of ferromagnetic alloys.

J. DORFMAN.

U.S.S.R., Leningrad (21),
Sosnovka 2, Phys.-Techn. Institute,
July 1932.

[1] R. Forrer, *J. Phys.*, October 1930, p. 325.
[2] C. Sadron, Dissert., Strasbourg, 1932.
[3] L. Néel, Dissert., Strasbourg, 1932.
[4] E. C. Stoner, *Proc. Leeds Phil. Soc.*, **2**, 149; 1931.
[5] From solid salts containing ions with the same number of electrons.

Influence of Light on the Gorging of *Culex pipiens* L.

IN connexion with the account given by Dr. Tate and Miss Vincent, in a recent letter to NATURE,[1] of experiments made by them and other investigators regarding the biting habits of *Culex pipiens* in England, the following corroborative observations may possibly be of interest.

During a long series of experiments carried out by us last year, in the course of which female mosquitoes of various species were fed in *daylight* upon human blood, we found that females of *Anopheles maculipennis, claviger, plumbeus*; *Theobaldia annulata, subochrea*; and *Aedes caspius, maculatus, rusticus, detritus, punctor, geniculatus* would bite readily enough. Females of *Culex pipiens*, on the other hand, were