measured proved that the activities of nickel and tin were only of the order of one hundredth of the very highly water sensitive ($\alpha = 15$) 5^m period of copper. It became thus evident that the purity of the metals employed was of great importance.

To check whether the 180^m period of nickel was really different from 150^m periods of the neighbouring elements, cobalt and iron, a steel counter was activated and its decay period measured. The half-life thus determined was 154^m, agreeing within the limits of precision with the value given by Fermi and others. From a number of determinations made with three different counters, it seems fairly certain that the 180^m period of active nickel is really different from the periods of its neighbours.

In the case of tin, the isotopes capable of being activated are probably 112, 122 and 124, and their combined relative abundance is only 12.3 per cent. Therefore the real activity of tin appears to be fairly strong. A rough estimation of the relative intensities of the two kinds of active nuclei showed that the activity with 18^m period is twice as strong as that with 8^m period.

The efficiency of this method of building counters with the substances to be studied as compared with that usually employed was roughly estimated in the following way. A thin-walled (0.042 gm./cm.²) steel counter was itself activated and its activity measured. Then a tightly fitting cylindrical steel foil of the same thickness as the counter wall was activated separately and its activity measured by putting it around the counter in the usual way. It was found that the efficiency was enhanced by a factor of about 4 when the counter itself was activated.

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² J. Rotblat, *NATURE*, **136**, 515 (1935).

Relation between Secondary Emission and Work Function

WHEN the work function of a metal is varied by depositing on its surface various amounts of a foreign substance (up to a complete monatomic layer), the ratio of secondary emission to primary current is found to change in the same sense as the thermionic emission, but to a much less degree. This difference of behaviour is due to the fact that the secondaries are emitted with velocities much greater than those of the thermally emitted electrons.

A quantitative estimate of the effect of variations of work function on secondary emission may be made on the basis of the known velocity distribution of secondary electrons. Using Haworth's data¹ for molybdenum, I have calculated the distribution of the normal components of energy, assuming the secondary emission at an angle θ to the normal² to be proportional to $\cos \theta$. The calculation shows that for secondaries having normal energies less than 5 electron-volts (a value which includes 52 per cent of the total number), the number N having normal energy greater than U may be represented approximately by the Maxwellian formula

$$\log_{10} N = A - bU,$$

where A and b are constants, the latter having the value 0.070 if U is measured in electron-volts.

This equation gives the number of secondaries having sufficient normal energy to pass through a potential barrier, of magnitude U , parallel to the surface. Since any change in the work function of a given emitter is equal to the corresponding change in the potential barrier at its surface, the equation should describe equally well the variation of secondary emission with work function.

Fig. 1. Relation between secondary emission and work function for molybdenum contaminated with barium.

I have measured the secondary emission (at a primary voltage of 300) from a molybdenum filament with different degrees of barium surface contamination. The corresponding changes of work function were derived from contact potential measurements with respect to a clean tungsten filament. Fig. 1, which gives the results obtained for the lower degrees of contamination, shows that the law deduced above is accurately obeyed, the value obtained for b being 0.067, which is in good agreement with the calculated value.

A similar relationship has been observed in the case of tungsten contaminated with oxygen, for which the secondary emission is less than that of the clean metal.

For atomically thick films, the above law was found to be inapplicable. This result might have been expected, since in this case a proportion of the secondaries arise in the film itself, whereas in the calculation it was assumed that the effect of the film was simply to modify the velocities of secondaries originating in the underlying metal.

It is hoped that a detailed account of these experiments will be published in due course.

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² H. E. Farnsworth, *Phys. Rev.*, **31**, 414 (1928).