

Citation:

A. Smits, The passivity of metals in the light of the theory of allotropy, in:
KNAW, Proceedings, 16 I, 1913, Amsterdam, 1913, pp. 191-192

Chemistry. — "*The passivity of metals in the light of the theory of allotropy.*" By Prof. A. SMITS (Communicated by Prof. A. F. HOLLEMAN).

(Communicated in the meeting of January 25, 1913).

It struck me already some time ago that the above-mentioned phenomenon, which has not been satisfactorily accounted for as yet, might be explained in a plausible way in the light of the theory of allotropy. We need namely only assume that, as the said theory requires, the metals are built up as a rule of different kinds of molecules, which in general have a different reactive power, so that one kind of molecules will act more readily than another. In this case the internal equilibrium in the surface of the metal will be disturbed by chemical action, and it will now depend on the rapidity with which the internal equilibrium will be restored whether or no anything particular occurs.

Let us take iron as an example, whose curve of heating of the solid substance betrays the presence of different kinds of molecules¹⁾, and let us immerse this in strong nitric acid. We then notice the following fact:

One kind of molecules is quickly dissolved, the other is not.

If it is now assumed that the oxygen split off by the nitric acid, which is possibly partially dissolved in the iron, acts as a negative catalyst for the setting in of the internal equilibrium, only the non-dissoluble kind of molecule will be left in the surface layer of the iron. If the iron plate is now taken out of the nitric acid, and rinsed with water, it appears that the iron no longer yields all kinds of known iron reactions. The strong metastable state in the surface can now however be suddenly disturbed by a blow, by the application of a magnetic field, by contact with positive catalysts, and in other ways; the inactive molecules are then again changed into the active ones, and the ordinary iron reactions have been restored. This may be demonstrated in all kinds of interesting ways. The periodic abrupt variations of the potential in the case of electrolysis of acids with iron as anode²⁾, may be explained in a similar way. This will, I hope, be soon-discussed in a following communication.

There are views among the earlier hypotheses, which show some relationship with the explanation given here, but on account of the

¹⁾ Cf. BENEDICKS "On allotropy in general and that of iron in particular. Journal of the Iron and Steel Institute" N^o. 11, 1912 p. 242.

²⁾ Adler. Z. f. phys. Chem. 80, 385 (1912).

exceeding vagueness of the conceptions of the nature of the solid state, and the absence of a general point of view, they have not been able to assume such a form as to lead to a satisfactory explanation.¹⁾

Anorg. Chem. Laboratory of the University.

Amsterdam, January 1913.

Chemistry. — "*The nitration of toluols and its derivatives chlorated in the side-chain*". By Prof. A. F. HOLLEMAN.

(This communication will not be published in these Proceedings).

¹⁾ It may be expected that in the near future it will appear possible also in many other cases to demonstrate by the use of solvents or chemical reagents the complexity also of those substances which have been considered up to now as behaving exclusively as unary substances.

(September 3, 1913).