the heat given out when a reversible isothermal reaction is carried on with the system maintained at constant volume, so that no external work is done. K is the "equilibrium constant" of the reaction, a quantity which does not change while the reaction is carried on isothermally. This equation has a firm thermodynamic foundation for reactions that can be reasonably conceived of as performed under certain conditions, first described by van 't Hoff. The author has long held that these conditions can not be conceived of as holding for the process of ionization within a solid metal, and he has therefore ignored equation (1) in his speculations concerning ionization, making certain hypotheses and reaching corresponding numerical conclusions without regard to any limitation imposed by this equation. He now finds that, for every one of the many metals studied, his numerical conclusions are consistent with an equation,

$$U = f \cdot KT^2 \frac{d \ln K}{dT} \qquad (2)$$

identical with equation (1) except for the presence of a numerical factor, f, in the second number. The value of f ranges from about 1.33 in nickel to about 3.13 in manganin, but for any one metal, though perhaps not entirely independent of temperature, it changes little if at all between 0° C. and 100° C.

Accommodation coefficients and heats of neutralization of gas ions at electrodes: K. T. Compton and C. C. Van Voorhis. When positive ions of a gas strike an electrode and become neutralized there are energy interchanges which result in heating of the electrode. Knowledge of this heating is important both in the interpretation of the physical phenomena which are involved and also in the practical design of gas discharge devices. With the aid of a thermocouple, and using this thermocouple as an exploring electrode in the ionized atmospheres of arcs at low gas pressures, we have studied the following factors which contribute to this heating: (1) the fraction of the incident kinetic energy of the ion which is delivered to the electrode (accommodation coefficient); (2) the fraction of the energy given to the ion by an applied electric field which is retained by the ion in spite of collision with gas molecules while approaching the electrode; (3) the portion of the apparent positive ion current to the electrode which is in reality due to electrons liberated from it under the influence of ultra-violet light, metastable atoms and positive ion impact; (4) the true "heat of neutralization" of the ion at the surface. The new and most important result of this work is the discovery that a considerable fraction of the kinetic energy of an impacting ion is retained after impact by the neutralized atom. The remaining fraction, which is delivered to the electrode as heat, is analogous to the "accommodation coefficient" which is recognized in the impact of ordinary gas molecules against a heated surface. In general these accommodation coefficients appear to approach unity for ions (or molecules) of high molecular weight. Our values are about 0.45, 0.7, 0.8 for ions of He, Ne and A, respectively. The existence of an accommodation coefficient less than unity, as thus proved by energy measurements, implies also that mechanical momentum is imparted by ions to electrodes in much larger extent than has hitherto been suspected. There are several observations on electrode arcs, which have been rather obscure, which seem thus to find a ready explanation. Of the four factors mentioned above as the objectives of our work, the first three are relatively so large in their effect that we have as yet been unable to arrive at definite conclusions regarding the fourth—the true heat of neutralization of an ion—whose determination would settle some interesting speculations regarding the mechanism of electric arcs.

The deformation of ions and the various types of chemical linkage: K. Fajans (by invitation). One distinguishes usually two main types of chemical linkage, the polar or ionic and the non-polar or covalent linkage. The polar linkage is typified by the inorganic salts, such as sodium chloride; the non-polar linkage by the bond between the two atoms in the hydrogen molecule or by the linkage between the carbon atoms in the diamond and in organic compounds. According to the modern conception of atomic structure the ionic linkage in sodium chloride is produced by the transfer of one electron from the sodium atom to the chlorine atom. The electrostatic attraction between the resulting positively charged sodium ion and the negatively charged chlorine ion holds them together to form a molecule or a crystal lattice. In the non-polar linkage the two atoms are assumed to be joined together by a pair of electrons shared by both atoms, and revolving round their nuclei. Between these two main types of chemical linkage there exists a whole series of transition types. Beginning with the ideal ionic linkage these transition types can be understood as the result of the polarization (deformation) to various degrees, of the electron shell of the anion by the electric field of the cation. The degree of this deformation and consequently the deviation from the ionic linkage and the approach to the non-polar linkage is greater when the radius of the cation is smaller, its charge higher and when the deformability of the anion is greater. This approach to the non-polar linkage is also more pronounced for cations which do not show the rare-gas structure than for cations with this structure.

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