

LETTERS TO THE EDITOR

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LAW OF ADDITIVITY OF MAGNETIC SUSCEPTIBILITIES IN HYDRATES

On the basis of Pascal's additivity rule, the susceptibility of a molecular combination is equal to the sum of the susceptibilities of the constituent molecules, provided no deformation takes place in the electronic orbits of the atoms of the combining molecules. It, therefore, follows that the susceptibility of a hydrate is the sum of the susceptibilities of the anhydrous salt and of the molecules of water of crystallisation. The data in this regard is, however, conflicting. Duchemin¹, Zimens and Hedvall² and Varadachari³ have found that the water of crystallisation in some hydrates behaves in an additive fashion, while the work of Raychaudhuri⁴ and the earlier investigation of Zimens and Hedvall⁵ show that the water of crystallisation does influence the susceptibility of the hydrates.

The authors determined the susceptibilities of a number of (1) anhydrous salts, (2) stable hydrates of these salts, and (3) several hydrates of the same salt containing varying molecules of water of crystallisation, in the solid state. The results, expressed in terms of -1×10^{-6} c.g.s. units, are given in the following table. Deducting the observed molecular susceptibility of the anhydrous salt from those of the hydrates, values have been calculated for the susceptibility per molecule of water of crystallisation (XH_2O) and are given in column 3. These values are widely different from the molecular susceptibility of water (12.96×10^{-6}) in the case of

almost all the hydrates, showing thereby that the hydrates generally do not obey the additivity law. Further in the several hydrates of the same salt, the departure from additivity is greatest in the hydrate containing the least number of molecules of water of crystallisation. Thus the deviations from the law, in all cases, depend upon the number of molecules of water associated with the molecule of the anhydrous salt. A graph drawn for the ratio of the weight of water to the weight of anhydrous salt against the deviation in the molecular susceptibility from additivity per molecule of water of crystallisation in the case of hydrates of several substances also supports the view-point that as the association of water molecules with an anhydrous salt increases the deviation from additivity decreases. These deviations have been explained on the basis of the binding forces between the anhydrous salt and the water molecules. It has been noticed that, in the case of several hydrates of the same salt, the heat of hydration per molecule of water of crystallisation (wherever available) increases as the number of molecules of water of crystallisation decreases. This shows that in hydrates containing least number of molecules of water of crystallisation the energy of binding between water molecules and molecules of the anhydrous salt is greater than in hydrates containing more water molecules. This observation supports the deduction mentioned above.

Raychaudhuri has found a relation between the percentage deviation in susceptibility from