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SOME RECENT DEVELOPMENTS IN THE STUDY OF THE SOLID STATE¹

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SINCE there are only three states of matter, one might say, just as a first guess, that the phrase "properties of solids" implied one third of all the knowledge of material things which has resulted from physical and chemical study. It is obvious, then, that only a few points can be touched upon in this discussion, and I must ask you to extend to me the modern privilege of applying my own "principle of selection" in any way I see fit. Even then, I am afraid it will be much like an extract from the well-known work of Mr. Wingleman, or an author's reading by Messrs. Landolt and Börnstein.

Without a doubt, the greatest advance of the past decade in the study of solids has been the application of the various X-ray methods of crystal analysis. This is particularly true in the case of the metals, and in other cases where the minuteness of the structure made the older methods difficult of application. The unique feature of the X-ray method, however, is, as Sir William Bragg has emphasized, that it gives a measure of the size of the crystal unit, out of which the crystal mass is built up. This unit is apparently much more characteristic and invariable than the external form of the crystal. Just how far the method can go in distinguishing slight differences between units can not yet be said, and as a consequence there is the possibility of larger repeating blocks built up of the presently accepted units, which may differ among themselves in ways at present indistinguishable. In this connection, there has been much discussion as to the status of the molecule in crystals. In some of the first crystals studied, rock salt and sylvine, for example, X-ray analysis gives no evidence of the existence of a "molecule"; in quartz, on the other hand, the molecule is easily distinguished,² and in organic crystals there is always a definite "crystal molecule" which will probably turn out to be identical with the chemical molecule. This question of the existence or importance of the molecule in crystals is just another way of putting the question of the nature and symmetry of attachments between atoms in the lattice structure, and other methods of study will un-

¹ Address delivered as President of the American Physical Society, in Cincinnati, December 27, 1923.

² McKeenan, *P. R.*, No. 2, 1923, p. 206.

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