Chemistry. — *"Some Remarks concerning the* RÖNTGEN*ograms obtained by means of Mica-Piles composed by crossed Lamellae"*. By Prof. F. M. JAEGER.

(Communicated at the meeting of October 30, 1920).

In a paper recently published [1]) on the RÖNTGEN-images obtained by means of a system of *mica*-lamellae crossing at definite angles φ, it was said in a Note on page 821, that the image obtained was evidently *not* a mere superposition of the images which were obtained by means of each of the composing lamellae separately, but that the RÖNTGEN-rays, after passing the first lamella, were apparently influenced during their passage through the next one in such a way, that the final result differed noticeably from the combination of the single images turned with respect to each other through the angle φ. This conclusion was founded in the first place on a comparison of the stereographic projections of the composed photographic images with the image obtained by the n times repeated superposition of the stereographic projection of the diffraction-image produced by a single lamella; and, secondly, on the fact that in the final photograph a considerable number of the outer spots were absent, which in the image of the single lamella appeared with appreciable intensity. At the same time a systematical investigation of this phenomenon was planned, because it was in contradiction with the usual interpretation of the diffraction-phenomenon now generally adopted.

At my request my colleague HAGA was kind enough to make the necessary experiments in the Physical Laboratory of this University; for his kindness and help I wish here to express my thanks once more. The result is, as will become clear in the following pages, that the conclusion mentioned in the Note on p. 821, cannot be considered as justified in its generality; and after these investigations we are compelled to acknowledge, that the images formerly obtained must really be considered to be, at least in their principal features, superpositions of the images of a single lamella, turned with respect to each other through angles φ, although certain deviations are certainly present, the causes of which will be explained further-on.

[1]) F. M. JAEGER, Proceed. R. Acad. of Sciences Amsterdam, **22**, 815, (1920).

The said experiments were executed by means of two very thin *muscovite*-lamellae, about 0,22 m.m. thick, which were obtained by cleavage from one and the same crystal, and which could be crossed with respect to each other at arbitrarily variable angles φ. In all cases, in which the angles φ were varied between 0° and 60°, the RÖNTGENograms obtained appeared to be almost the complete superpositions of the images of the composing thin lamellae. From this result it became more and more probable, that the images formerly obtained might finally appear to be also such superpositions. For the purpose of investigating this more in detail, a negative was prepared from the original image of a single lamella, as reproduced in Fig. 1 of the Plate, and from this a number of equal diapositives were made on pieces of photographic film. These film-diapositives were now carefully piled-up at the angles φ with respect to each other, in the same way as the lamellae in the mica-piles used formerly. The thus obtained combination was carefully compared in transmitted light with the original photos formerly obtained. Although some spots of the primary images did not coincide completely with other spots, also in these cases their mutual distances might be considered small enough to give together the final impression of one spot of greater intensity. If this be taken into account, the combined image is really in its principal features analogous to the photographic image of the mica-pile. However, there are certain deviations: some spots were lacking in the last photographs, which were visible in the film-image with rather great intensity; some spots were feebler than in the film-image, and generally the relative intensities of the spots were different from those in the image of the combined films.

Partially, these deviations could be easily explained by the influence of a *selective absorption* of some wave-lengths, as already stated in former cases, when the rays of the tungsten-anticathode of the Coolidge-tube pass through thicker layers of the crystalline medium. With the aid of a muscovite-crystal of 2,35 m.m. thickness it was possible, indeed, to prove that certain spots in the diffraction-image obtained with it, — e.g. the spot in the middle of the first circular row beneath the centre of Fig. 1 of the Plate, — were convincingly less intense than the corresponding spots in the image obtained with a 0,22 m.m. thick lamella of the same crystal; and exactly in those places also the spots were absent in the composed image of a mica-pile of circa 3,5 m.m. thickness. By intentional experiments, in which the time of exposure was regulated in such a way, that the influence of solarisation-phenomena of the most intensive spots was certainly excluded, it could be proved

beyond all doubt, that such a selective diminution of the intensities of some spots with respect to others really happened in cases where the RÖNTGEN-rays had to pass through thicker layers of a crystalline medium. Undoubtedly this selective absorption is, at least partially, responsible for the abnormal intensity-relations in the composed photogram of the mica-piles, compared with the corresponding relations in the film-combination. However, a certain momentum for this appears also to be the strong veil on the background of the photographic plate in the first case; a veil, which may in the final photos of the piles also be the cause of the absence of the outer and feebler spots of the image obtained with a single lamella, because the photographic plate could not be developed a sufficiently long time to make them appear upon it. This photographic veil is, therefore, also one of the causes of the misleading aspect of the photograms of the mica piles, so that they seem to be different from a true superposition of the images obtained with a single lamella. That besides this, also the use of the stereographical projections instead of the film-combination, formerly led us to a conclusion which is now acknowledged as erroneous, need not surprise us: for in the stereographical projections the intensity of the different spots was not measured photometrically, but estimated in a purely subjective manner, and in thus comparing *different* stereographical images with each other, properly incomparable intensities are checked with respect to each other. These circumstances may elucidate why the photographical images of the mica-piles were formerly not recognised as being mere superpositions of the single images composing them. However, the veil of the photographic plates is probably amongst all cooperating causes of greater influence than the unequal diminution of the intensities of the spots by selective absorption. In any case no truly new phenomenon is here present of a kind inconceivable with respect to the generally adopted interpretation of diffraction-phenomena in crystals.

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Chemistry. — "*On the Validity of the Law of Partition for the Equilibrium between a Mixed-Crystal Phase and a Coexisting Liquid*". I. By Prof. A. SMITS. (Communicated by Prof. P. ZEEMAN).

(Communicated at the meeting of May 29, 1920).

Since 1911 I have more particularly been occupied in researches which in connection with the theory of allotropy were undertaken with a view to the study of the solid state.

These researches had led to views about the solid state which are incompatible with the image given by BRAGG in view of the Röntgen-spectra found by him.

Mr. SCHEFFER and myself[1]) have pointed out that when a grouping of *atoms* is assumed in the lattice points of a crystal lattice, the bindings being disregarded in accordance with the valence, there arise great difficulties. On that occasion we gave a model solely with a view to indicating the direction in which in our opinion the solution should be sought, and it is clear that the question whether this model it serviceable or not, leaves the objections advanced by us against BRAGG's representation, entirely intact. Our paper was written solely to set forth these objections. Our efforts are only tentative as yet, and it seems to me that the Röntgen investigation of the solid substance in its present state does not yet enable us to get to know the real internal condition.

Nevertheless this investigation must be considered of the utmost importance, and the hope may be cherished that continuing in this direction one day the way will be found that leads to that which interests us most, viz. to the manner in which the chemical action in the solid substance is manifested.

The objections to BRAGG's conception will be fully discussed and supplemented elsewhere; here I will, however, point out that it might be said that the objections for a definite group of compounds, viz. those that are built up of two elements and can split up into ions, might be *partly* obviated, when it was assumed that this dissociation in the solid state was a *complete* one.

It is clear that then for this group of substances as KCl and

[1]) These Proc. **19**, 432 (1916).