

doublet $2s - 2p_{1,2}$, $\lambda\lambda$ 10829.1, 30.3. Until we have a satisfactory theory of the helium arc spectrum speculation as to the new line will be useless.

An interesting feature of the spectrum of the thermionic discharge in lithium is the unusual development of the subordinate series. Eleven lines of the sharp series and 16 of the diffuse were plainly seen on one of the plates. Only six and seven, respectively, are listed in tables of series lines. The principal series was recorded to the tenth line.

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ON THE DISPERSITY OF SILVER HALIDES IN RELATION TO THEIR PHOTO- GRAPHIC BEHAVIOR

IN an article appearing in *SCIENCE* for October 26, 1923, under the above heading, Dr. Frank E. Germann and Mr. Malcolm Hylan query a conclusion reached by Wightman, Trivelli and Sheppard, on the relation of grain size and photographic sensitivity. Their first questioning of the conclusion that the sensitivity increases with the grain size is based on an example quoted in "Monographs on the theory of photography," No. 1, p. 104, where comparison of two emulsions showed that the one having grains one third the linear dimensions was more than 19 times as fast and that the same was true of individual grains in the same emulsion. The explanation of this discrepancy has been amply provided subsequently by discoveries concerning the function of sensitive specks in the silver halide grains.¹

They quote further the conclusion of Koch and DuPre that "it is not possible to formulate any definite relationship between the grain size and sensitivity with the information at present available," to which it may be replied that very much more data are now available than were at hand at the time that Koch and DuPre made their statement.

With regard to the theoretical considerations they advance, we find ourselves in considerable disagreement with them. They conclude, on the nuclear theory (without specifying what they mean by the nuclear theory), that the speed depends on the *number of grains affected* without reference, therefore, to the size of the grains. It can be seen from the work of Svedberg and others that this argument is entirely in contradiction with the present nuclear theory, since the number of specks or nuclei increase with the size of grain and, therefore, the chance of a grain being made develop-

able by light increases with its size. As we have pointed out in other papers,² this result is independent of whether the continuous wave theory or the quantum theory of the constitution of light be adopted. The decision between these two theories must be reached on other grounds. Consequently, we can not agree that "theoretically the smaller grained emulsion should be the more sensitive," but rather the reverse. We may point out in this connection that the writers have not defined exactly what they mean by "sensitivity." Speed, in the usual photographic significance of the term, depends on density measurements, that is, on the number and size of the developed grains conjointly. Sensitivity can be determined microscopically from counts of grains independently of density measurements and the sensitivity of grains of a given size can therefore be specified in a manner independent of such density measurements.

It does not appear necessary, therefore, to discuss their explanation of a discrepancy between experimental results and those theoretically expected, which discrepancy does not in our opinion exist.

We shall await publication of their experiments on removing adsorbed halide from silver bromide grains with interest, but prefer to postpone discussion of this until we have their fuller data.

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THE AMERICAN CHEMICAL SOCIETY

(Continued)

DIVISION OF ORGANIC CHEMISTRY

Frank C. Whitmore, *chairman*

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The uses of acetylene in synthesis: J. A. NIEUWLAND.

The evolution of acetylene in organic syntheses began with the introduction of catalytic agents to effect reactions. Some of the following important types of catalytic syntheses were discussed: A—The halogenation reactions, typified by (a) catalytic $AlCl_3$ reactions; (b) catalytic $SbCl_3$ reactions. B—Catalysis with mercury salts, as (a) acetaldehyde, glacial acetic acid and acetone; (b) paraldehyde synthesis; (c) synthesis of ethylidene diacetate, acetic anhydride, formaldehyde and methyl acetate; (d) synthesis of acetals and cyclic acetals; (e) synthesis of acetylene with aryl hydrocarbons; (f) synthesis of acetylene with phenols (bake-lite), and the dinaphthylols; (g) synthesis with reacting substances in solution, aldehyde blue, and green, acridine and xanthene dyes. Quinaldine, indole, cinnamic aldehyde, nitro cinnamic aldehyde and indigo. C—Syntheses with Cu_2Cl_2 , as (a) divinyl acetylene, and derivatives ($HCHO$); (b) quinaldine and quinine de-

¹ See papers of Svedberg, *Phot. Journ.*, 62, 186, 316 (1923); Toy, *Phil. Mag.*, 44, 352 (1923); *ibid.*, 45, 715 (1923); Silberstein, *Phil. Mag.*, 44, 252, 955 (1923); *ibid.*, 45, 1062 (1923); S. E. Sheppard and E. P. Wightman on "The theory of photographic sensitivity," *SCIENCE*, 1923, pp. 89-91.

² *J. Franklin Inst.*, 194, 485 (1922); *J. Phys. Chem.*, 27, 141 (1923).