

On the Sensitivity of Photographic Emulsions for Electrons Between 50 and 100 kev

Because the papers published¹⁻⁵ up to now contain little information about the relative sensitivities of different photographic emulsions for electrons with speeds of 50 to 100 kev, the author believes it useful to describe some measurements made by him in this field.

One classification of emulsions, by Knoll and v. Borries,⁵ has been established for exposure times of 10^{-8} to 10^{-7} second. The present measurements were made for exposures of 10^{-3} to 1 second. They indicate only relative values, not absolute sensitivities. The objective is to permit the choice of the best emulsion for electron microscopy, or similar purposes, so that the relative amount of blackening obtained with different emulsions, rather than the absolute ratio of blackening to incident charge, is the factor of importance. Therefore a standard emulsion has been chosen and all the blackening values measured with reference to this standard emulsion.

The experimental procedure was as follows: The different emulsions to be compared were cut in strips and placed side by side in a cassette. The emulsions which had to be compared were exposed to the electron beam simultaneously with the standard emulsion and developed and fixed together. This procedure does not give directly either absolute blackening curves or the variation of sensitivity as a function of the electron velocity. If these functions are to be determined, the absolute value of sensitivity of at least one of the emulsions must be determined as a function of the intensity of incident beam and velocity.

The comparison was made by using the electron microscope described in previous articles,⁶ removing the specimen holder from the object chamber. The coil currents may be adjusted so that an area of uniform current density of 60-mm diameter is obtained in the photographic cham-

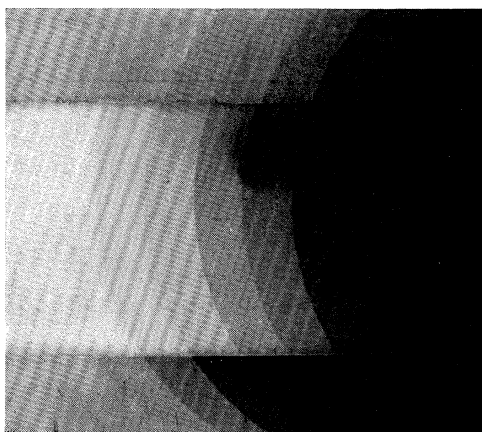


FIG. 1. Appearance of photographic emulsions exposed to electrons.

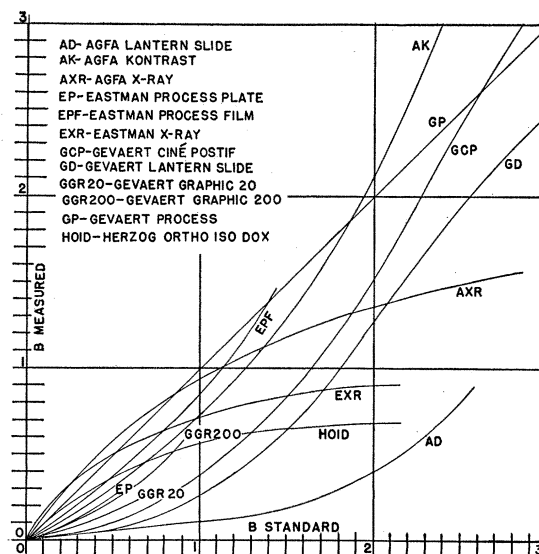


FIG. 2. Comparison of blackening of emulsions.

ber. After having exposed the emulsions for the first time for a short duration, the cassette containing them is displaced several millimeters and a second, longer, exposure is superimposed. By repeating this procedure several times, a series of blackenings is obtained. Fig. 1 shows the appearance of the exposed emulsions. This procedure presupposes the Bunsen-Roscoe law to be valid for electrons, which seems to be established by a great number of experimenters.

The measurement of the blackening was accomplished by means of an improvised microphotometer consisting of a microscope with a barrier layer cell substituted for the eyepiece. Fig. 2 shows results obtained for the blackening of the measured emulsion as a function of the blackening of the standard emulsion. As standard the Gevaert Process Plate has been chosen. The blackening of this necessarily appears in the curves as a straight line at 45° to the axis.

This comparison seems to show that for a low value of blackening x-ray films are more sensitive than any other type of emulsion chosen. On the other hand, if we desire higher values of blackening, the process type emulsions are more suitable. It is thus not possible to order emulsions according to their relative merit, as the latter depends on the range of blackening covered.

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² A. Becker and E. Kipphan, Ann. d. Physik **10**, 15 (1931).

³ H. Schaffer, Archiv f. Elektrotech. **26**, 313 (1932).

⁴ B. v. Borries, Thesis Berlin 1932, Forschungsheft 3 der Studiengesellschaft f. Hochspannungsanlagen, Berlin, 1934.

⁵ B. v. Borries and M. Knoll, Physik Zeits. **35**, 279 (1934).

⁶ L. Marton, Bull. Acad. Belg. Brux. **21**, 606 (1935).

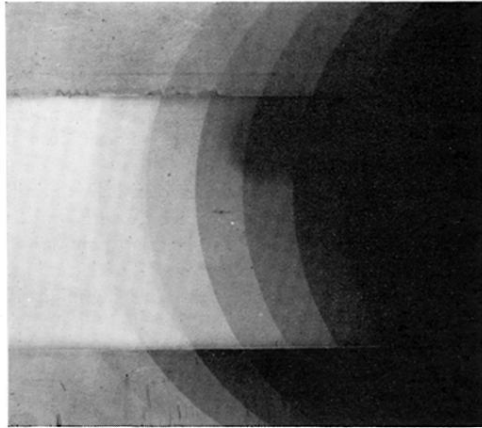


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