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Hypersensitization of emulsion 8E75 Agfa-Gevaert using forming gas

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ABSTRACT. We have hypersensitized emulsions 8E75 Agfa-Gevaert in forming gas obtaining a considerable increment in the speed gain as occurs in other photographic emulsions used in astronomy.

RESUMEN. Hemos hipersensibilizado emulsiones 8E75 Agfa-Gevaert en gas formador, obteniendo incrementos considerables en la velocidad de ganancia, así como ocurre en otras emulsiones fotográficas utilizadas en astronomía.

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The hypersensitization consists in icreasing the speed gain of photographic emulsions. At the beginning of the 1970's, some experiments were done with spectroscopic plates [1] at different controlled atmospheres of several gases in which the Nitrogen gas showed to be good to increase the speed gain in photographic emulsions. Later, some studies showed that Hydrogen gas was the best, but the explosive character of this gas created suspicion among some experimenters. Besides this difficulty, the problem was resolved introducing the so called forming gas [2] which consists of a mixture of Hydrogen and Nitrogen. It has been demonstrated to give excellent results with a little increase in chemical fog [3]. We used Hydrogen concentration of 8 percent and 92 percent of Nitrogen [1] for baking the emulsion at different times. Three samples of these emulsions were hypersensitized at 1, 3, and 9 hours at 50°C using the commercial LUMICON$^{\text{TM}}$ hypersensitization kit model 600. And another sample was not hypersensitized, it served as a reference plate. In each one were recorded 18 intensity luminous spots levels during a time of 30 minutes utilizing a spot sensitometer of the Astronomical Observatory in Cananea, México, which uses a

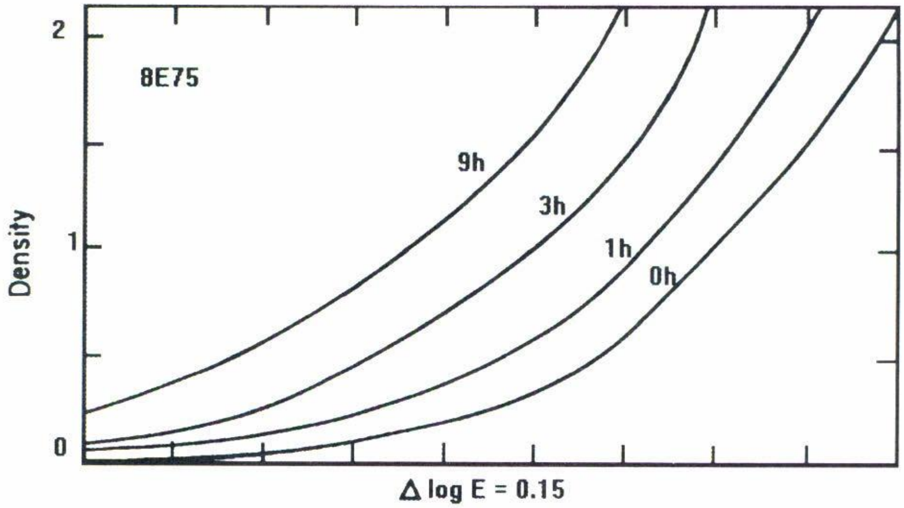

FIGURE 1. Characteristic curves (densities *vs.* log exposure) of the 8E75 emulsion at 0, 1, 3, and 9 hours of hypersensitization in forming gas.

white light source with electronic control to maintain the best uniformity of the light on the sample and under the same conditions of exposure time and developing (D-19). The four plates were carefully processed to avoid the introduction of strange effects, such as dust particles, light variations and temperature changes of the environment. The optical densities of each one were measured with a microdensitometer Perkin-Elmer model PDS1010A of the Centro de Investigación Científica y de Educación Superior de Ensenada.

Figure 1 shows the characteristic curves obtained for each sample. One observes from this graph the shift to the left of the curves caused by the baking time in the hypersensitization process. The meaning of this is that less time of exposure is required to produce a given density.

As in other works in the field, we define speed gain as the ratio of the exposures necessary for the reference plate and the treated plate, respectively, to reach a density of 0.6 above fog [4]. These ratios are derived from Figs. 1 and 2. Our results show a considerable gain value over 2 for a 3 hour treatment. Because of this technique a little increment in fog density is observed. This makes it possible to work with long hypersensitization times to get a speed gain of 3 or greater.

We did not find from the hypersensitization technique literature information related to spectral absorption changes from the emulsions with respect to wavelength in increasing gain, neither the variation gain with respect to the resolution film. Our purpose was to obtain the characteristic and gain curves and not the absorption spectral emulsion. However, we think it would be a good task to realize it; but this corresponds to material sciences. Because we used white light, it is not possible to infer what is the best energy expressed in ergs to each wavelength. In such a case, we would have to obtain the characteristic curves to each wavelength; for example, in the Newport 1994 catalogue [5] for the emulsion 8E75 to a given density is showed a sensitivity table expressed in ergs/cm^2 for different lasers and determined wave-lengths and we observe no changes in the emulsion resolution. Our

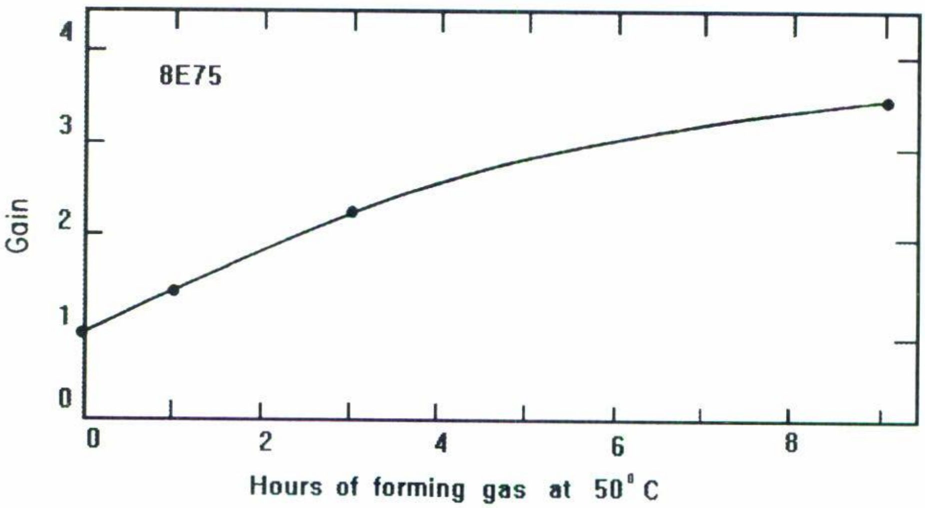

FIGURE 2. Speed gain as function of hypersensitization time for the 8E75 emulsion.

sensitivity was 100 ergs/cm^2, which is of the order of any monochromatic source as cited above.

The application of this technique to this type of emulsions makes it possible to reduce considerably the time response by many factors. This is important when someone wishes to work with optical tables that usually are very expensive and takes long exposure times on emulsions to be recorded; furthermore, a good vibrational mechanical stability of the table is required. Thus, the hypersensitization of these emulsions subdue these obstacles and we can use optical tables with short exposure time expended.

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