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Platinum Metals in Photographic Emulsions

A STUDY OF THEIR EFFECTS ON SENSITIVITY

During the last few years a considerable increase has been made in the sensitivity of photographic emulsions with little increase in grain size. Some at least of this improvement is due to the use of noble metals as sensitizers and general emulsion improvers.

In the course of a symposium on "The Ultimate Sensitivity in Photography—Today and Tomorrow" organized last year by the Royal Photographic Society, a contribution on this subject was presented by two independent workers in the field, A. Narath and A. Tiilikka, of the Institut für angewandte Photochemie und Filmtechnik, Technische Universität, Berlin. Their paper, now published in *The Journal of Photographic Science*, 1961, **9**, 303–311, describes their investigation by potentiometric methods of reactions between gelatin and the noble metals.

In a review of the literature, the authors point out that although the sensitivity of silver bromide suspensions is increased by the addition of gold, platinum and palladium, much of this is lost in the presence of gelatin and other colloid vehicles, which at present are essential emulsion constituents. This restraining effect is apparently due to interaction in the emulsion between the noble metals and gelatin or its microcomponents, with the result that the metals cannot completely penetrate the adsorbed gelatin layer on the silver halide grains to increase their sensitivity.

In their investigation the authors simulated photographic emulsions, but excluded silver

halides. The reactions were followed potentiometrically using gold, platinum and palladium electrodes and a saturated calomel reference electrode. Concentrated gelatin, polyvinyl alcohol control solutions, gold thiocyanate complex and K_2PtCl_4 and K_2PdCl_4 solutions were used.

The results of the titrations were compared with emulsion sensitising tests, using a simple bromo-iodide emulsion employed in earlier work. This contained 0.088 moles silver and about 25 grammes gelatin in 250 millilitres emulsion at the beginning of digestion. All titrations and emulsion digestions were made at pH 6.

The gelatins giving the greatest sensitivity with silver halides were found to have the strongest reaction with the noble metals, preventing them from sensitising the silver. Platinum and palladium react more strongly than gold, and consequently have a greater restraining effect on sensitivity. The metals also react with many organic sulphur-containing sensitizers and ripening restrainers used in emulsions.

The authors suggest that platinum and palladium (and also iridium and rhodium) might be used to increase emulsion sensitivity and/or contrast, providing that low concentrations of gelatin are used and that the gelatin contains reducing agents, or alternatively that colloid vehicles are used which do not form strong complexes with the platinum metals. They propose to continue their investigation in these directions.

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