Spectroscopic Applications of Photographic Emulsion Mosaics

A COMPREHENSIVE spectral survey over as wide a wave-length range as possible is a frequent early requirement during spectroscopic studies of terrestrial and astronomical light sources. Such surveys are often made with low-dispersion prism spectrographs, and sometimes with grating instruments.

The availability of Kodak O to Z emulsions[1] (and similar emulsions of other manufacturers, for example Ilford Q emulsions), each sensitized to have a maximum response in a different wave-length region, enables a spectroscopic survey to be made by a sequence of separate exposures of different emulsions, each selected on the basis of wave-length range of maximum sensitivity. In cases where only one exposure is possible or practicable (for example, to transient and/or very feeble light sources) one specific emulsion (for example, 1–N or 103 aF) is often used as the most acceptable compromise for high sensitivity over as wide a wave-length range as possible. The inherent variations in the sensitivity of a single emulsion over the wide wave-length range often give rise to non-uniformly exposed plates.

The availability of the Kodak emulsions on films, however, makes it possible to assemble mosaics made up of two or more segments of different emulsions, each easily cut to a length specific to the wave-length range of its maximum sensitivity. For example, the "Kodak Data" book[1] specifications of relative emulsion sensitivity (defined therein as the reciprocal of the exposure to tungsten radiation in metre candles seconds which will produce a density of 0·6 above gross fog when the material is developed for the recommended time in Kodak developer D–19) show that a mosaic of optimum sensitivity to 9000 Å. may be assembled by using type O emulsion to 5000 Å., type F emulsion between 5000 Å. and 7000 Å., and type N emulsion between 7000 Å. and 9000 Å. In addition, the range of optimum sensitivity can be extended, if required, to 12,000 Å. by using hypersensitized M emulsion between 9000 Å. and 9800 Å., hypersensitized Q emulsion between 9800 Å. and 10,200 Å., and hypersensitized Z emulsion between 10,200 Å. and 12,000 Å.

The gain in sensitivity obtained by the use of an optimum emulsion mosaic in place of a single emulsion is illustrated in Fig. 1, compiled from individual sensitivity curves given in the "Kodak Data" book. An emulsion mosaic assembled in the manner specified

above is a detector the sensitivity of which as a function of wave-length is an envelope of the individual curves of Fig. 1. The response of O emulsions is not given in the "Kodak Data" book below 4000 Å., but, as is well known, O emulsions perform adequately between 2000 Å. and 5000 Å. The mosaic sensitivity can be extended to shorter wave-lengths by use of Ilford Q emulsions or other Schumann type emulsions.

The practicability of using emulsion mosaics has been tested by using segments of 103–aO, 103–aF, and 1–N 16 mm. film in conjunction with Hilger medium quartz and medium glass spectrographs. A flexible rectangular brass plate (10 in. × 4 in.), to which brass guides were attached to hold the film segments, was used in the spectrograph plate holder in place of the usual glass plate. Each segment of film, of a length appropriate to its wave-length range of maximum response, was cut with slightly oblique ends, which matched those of its neighbours. In this way no spectral features were lost at the boundaries between segments. The mosaic, and separate strips of O, N, and F film equal in length to the mosaic, were exposed for equal times to a microwave discharge through carbon dioxide the spectrum of which is rich in carbon monoxide features over the entire wave-length range of each spectrograph. In contrast to the abrupt variations in exposure obtained along each of the single emulsions, a relatively uniformly exposed spectrum was obtained in each case on the mosaic as expected.

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[1] "Kodak Photographic Plates for Scientific and Technical Use", seventh ed. (Rochester, New York, 1953).
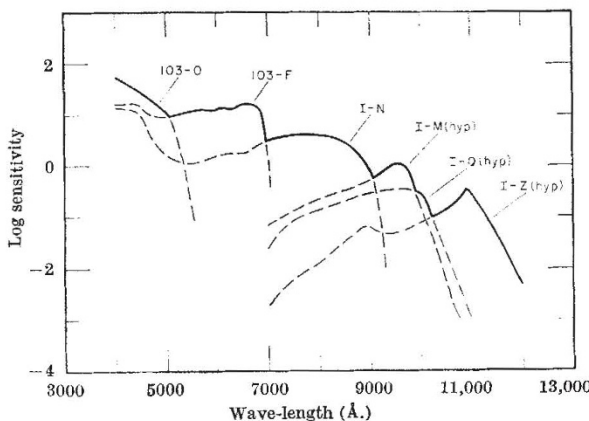

Fig. 1. Relative sensitivity of Kodak emulsions and optimum sensitivity of emulsion mosaic (solid curve)

Nature of Cupric Alkanoate Solutions

THAT the cupric salts of alkanoic acids occur in the solid state in the form of dimeric molecules is shown by van Niekerk and Schoening's X-ray analysis of cupric acetate hydrate (I, $R = CH_3$, $L = H_2O$)[1] and by Martin and Waterman's magnetic studies of the acetate and some higher homologues in hydrated and anhydrous forms[2]. Tsuchida and Yamada have shown that a further characteristic of this structure is the occurrence of an absorption band about 375 mμ, polarized in the copper–copper axis, in addition to the usual 'copper band' about 700 mμ[3,4].

(I)