

## SHORT COMMUNICATIONS

### SODIUM CHLORIDE SENSITIZING OF FAR ULTRAVIOLET SPECTRUM PLATES\*

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It is well known that the absorption spectra of some crystals may be permanently changed if the crystals are exposed to photons with energies of tens or hundreds of electron-volts. It is therefore desirable, when studying absorption of far ultraviolet radiation in an ionic crystal, to expose it only to radiation of the wavelength for which its absorption is to be determined, rather than to a wide range of wavelengths. The usual techniques do, in fact, expose the crystal to the whole spectrum over which absorption measurements are required — either simultaneously (before dispersion) or sequentially (as with a scanning monochromator).

Absorption spectra may, however, be recorded in a spectrograph by coating part of the photographic plate with the material concerned. The spectrum of a suitable light source is then recorded so that each spectrum line spans the boundary between coated and uncoated photographic emulsion. The reduction in the blackening produced by any one line due to absorption in the coating can then be measured. If the (polycrystalline) coating thickness is known, the absorption coefficient of the coating material can thus be deduced for each wavelength recorded.

This technique avoids exposing the absorber to all wavelengths, but fails if the absorption of primary radiation by the coating leads to fluorescence or photoelectric emission, to which the adjacent emulsion may respond as though to transmitted primary photons. The coating then becomes a sensitizer and this scheme has been used widely to extend the useful wavelength range of plates and photoelectric detectors into the far ultraviolet.

We have attempted to use partly coated Ilford "Q" plates (sensitive throughout the extreme ultraviolet wavelength range) to study the absorption spectrum of sodium chloride. While absorption measurements are possible at the longer wavelengths, we have found that sodium chloride acts as a sensitizer over wide ranges of wavelength. Our primary purpose here is to report this as a result of technical interest.

In our exploratory experiments, Analar grade sodium chloride was dissolved in distilled water at concentrations of the order of 100 g/l. Ilford Q2 plates were dipped in this solution for 5 s and dried, so that the plate consisted of adjacent 10 in. by 1 in. zones, one coated with sodium chloride and the other untouched. The line spectrum from a capillary spark discharge was recorded between 150 and 1800 Å in a Hilger grazing-incidence, 2 m grating spectrograph. Limiting stops were removed to give lines some 15 mm in length, half incident on the coated zone and half on the

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emulsion directly. The plates were carefully washed before development to remove all sodium chloride.

In the spectrograms obtained in this way, all lines below about 300 Å were apparently enhanced by the coating (checked in three orders of the spectrum). Regions of line enhancement appeared at several longer wavelengths, close to known features in the electron energy-loss spectrum of sodium chloride (see Table 1). Densitometer measurements showed that the line enhancement due to the coating was equivalent to an approximately threefold increase in exposure at enhanced wavelengths above 300 Å and an approximately eightfold increase at shorter wavelengths. The enhancement appears to be uniform for all wavelengths from 150 to about 280 Å.

TABLE 1  
CHARACTERISTIC ENHANCEMENT AND ELECTRON ENERGY LOSS ENERGIES

Enhancement Energies (eV)	Electron Energy Loss Energies (eV)		
	Lynch (1963)*	Best (1962)	Marton <i>et al.</i> (1955)
	6		4.8
	8.5	8.7	8.3
		12.7	12.4
		15.5	15.4
19			
23	21	22.2	21.0
27.5	28		
33	36	33.5	33.3
	41		36.8
44	45	44.5	
	50.5		

\* Personal communication.

Control experiments were performed by immersing plates in the sodium chloride solution under the same conditions, then washing off the sodium chloride with water, exposing, and developing the plates. No enhancement was found. This indicates that the enhancement is due to the presence of the sodium chloride during exposure and not to any chemical interaction of a component of the emulsion with the solution.

Sodium chloride coating by this simple method is therefore an effective way of sensitizing Ilford Q emulsions for extreme ultraviolet spectroscopy. It has the further advantage of greatly reducing the scattered light background, which is of predominantly longer wavelengths than 350 Å and is not enhanced and may even be absorbed. The resultant improvement in line to background ratio is striking.

A full investigation of the processes of enhancement in sodium chloride and in other alkali halides is proceeding.

### References

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