

In the tensile experiments on bars of silver chloride, the [110] direction lying in the glide plane was always that one of the six equivalent [110] directions which lay most nearly at 45° to the direction of the tension, or, if there were two glide systems in the same grain, the two [110] directions nearest to the 45° position were selected. Moreover, the glide plane was never more than 9° away from the plane of maximum resolved shear stress containing this favourable [110] direction. This evidence strongly suggests that at room temperature silver chloride becomes deformed by 'pencil glide'⁴ in the [110] direction. In iron crystals, pencil glide is connected with the fact that at room temperature the critical stress for glide is the same on three different crystallographic planes, all containing a common glide direction. It seems that this process has not been observed until now in any other crystals. A pencil glide can easily spread from one grain to its neighbour, and this explains the frequent occurrence in the silver chloride sheets of slip lines continuing across grain boundaries.

In single crystals of silver chloride extended by simple tension, Stepanow⁵ found glide on planes within 5° of {110} in a [110] direction. This result is in agreement with the conclusions reached above, for in Stepanow's experiments the crystals happened to be prepared with a {100} plane perpendicular to the axis of tension and, under these special conditions, the glide elements to be expected on the present theory are just those that he reported.

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⁴ Taylor, G. I., and Elam, C. F., *Proc. Roy. Soc., A*, **112**, 337 (1926).

⁵ Stepanow, A. W., *Phys. Z. der Sowjetunion*, **6**, 312 (1934); **8**, 25 (1935).

Thickness and Height of the Sodium Layer Responsible for the Strong Yellow Line in Twilight

IN a communication in *Nature*¹ in 1940 I gave a short account of results of investigations on "The Atmospheric Layer from which the Yellow Line in Twilight Originates". From a series of spectrograms from the zenith followed by one from near the horizon, the effective screening height (H_s) of the atmosphere and the upper limit (H_u) of the effective sodium layer were determined. Since then, the results of extensive series of observations from Oslo and from the auroral observatory at Trömsö have been published^{2,3}.

All observations give nearly the same value of (H_s) and (H_u). The mean values were found to be $H_s = 49$ km. and $H_u = 110$ km. The results lead to the conclusion that ultra-violet radiation in the region near 2,500 Å., strongly absorbed by ozone, is essential for the excitation of the sodium line in twilight.

Photometric measurements of the intensity of the line for successive twilight spectrograms show that as a rule the intensity keeps nearly constant until it suddenly falls to a lower order of magnitude in the course of a short time (Δt), when the shadow produced by the screening layer leaves the upper limit (H_u). If the sodium layer had been evenly effective

throughout the whole interval ($H_u - H_s$), the intensity should have decreased gradually during the time it takes for the effective shadow limit to pass from H_s to H_u .

It is therefore legitimate to conclude that the effective sodium layer is restricted to a thin layer, and that the sudden drop of intensity of the D -line begins when the shadow reaches the lower limit of this layer.

Using the zenith observations, the thickness (ΔX) of the layer is given by the formula:

$$\Delta X = (R + H_s) \cos \varphi \frac{\sin h}{\cos^3 h} \cos \delta \sin t \Delta t,$$

where R is the radius of the earth, and h , δ and t the height, declination and hour angle of the sun. The value of ΔX has been calculated for twenty series of observations taken at Oslo between October 1942 and April 1943.

The values found for ΔX vary between 8.4 km. and 27.6 km., with an average of 16.2 km. The fluctuations are greater than the possible errors and are, no doubt, to a certain extent real. The values indicate a minimum in December and January and maxima in the autumn and spring. A regular annual variation of H_u and H_s has not yet been found. On an average the sodium layer effective in producing the strong D -line in twilight seems to cover a height interval from about 90 to 110 km.

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Treatment of Paper with Silicon Esters

DURING an investigation of the possibility of cross-linking nitrocellulose molecules in solution with silicon esters^{1,2}, some experiments were also made with cellulose itself in the form of filter paper or unsized kraft paper.

The silicon esters used were tetramethyl, tetraethyl and a polymer ethyl ester (boiling range 210–360°). In a first series of experiments, ordinary filter papers (11 cm. diameter) were exposed to vapours of silicon esters at high temperatures and afterwards placed in a funnel, which was then filled with water. Treatment with ethyl ester for 16 hr. at 120° produced a filter paper which was completely impermeable to water for 11 hours. In a second series of measurements the treatment was made with liquid esters instead. Papers which had been immersed in polymer ethyl ester for 4–66 hr. showed a regularly increasing impermeability against water, improving from 1 to 50 hours. Unsized kraft paper gave similar results, whereas experiments with sized paper of different kinds were unsuccessful.

The wet strength of treated unsized kraft paper was three to seven times larger than that of untreated paper. In order to get the treated papers completely wetted, it was necessary to keep them immersed in water for about one week.

It is also possible to carry out the treatment in such a way that no water repellency is observed but a considerable increase in wet strength is obtained. These experiments were made with very thin filter papers known as 'Stilex' (used in the filtration of