

This is largely a technique for studying features above the general level, that is, particles, hillocks, shelves, elevations, etc., rather than one for looking into hollows, unless in fact the hollow has a much larger flat bottom extension than its height. In some cases contrast is decidedly improved by plane polarizing the illuminating beam, largely through cutting out scatter from the object.

It should be noted that the shadows of single particles may at times be forked or show a multiple structure, revealing thus unsuspected peaks or valleys on the surfaces of the particles. The patterns given by transparent crystallites require to be interpreted with reference to the possible transmitted light which can appear within the centre of the shadow.

Quite apart from the height-measuring capabilities of this system, the grazing illumination on the fine-grain matt surface turns out to be a new vivid technique for revealing topographical features by creating new contrasts. It is, of course, a modified form of controlled and heightened dark-ground illumination. One sees far more by this technique than by direct microscopy.

S. TOLANSKY

Royal Holloway College
(University of London),
Englefield Green,
Surrey.
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Polarized Ultra-Violet Absorption of Anthracene

THEORETICAL calculations of π -electron states in aromatic molecules give values for three important properties of spectral transitions. These are the wavelength, intensity and polarization of the band systems which correspond to jumps between the calculated states.

Finding the polarization of observed band systems to check the calculations is more difficult than finding the wave-length and intensity, and has not often been attempted in aromatic hydrocarbons except in the weakest band systems, for which quite thick crystals give measurable optical densities^{1,2}. However, by working with the thinnest sublimation flakes that could be transferred without shattering to a silica plate, we have now measured the polarizations of some stronger systems in the near ultra-violet spectrum of anthracene.

The thinnest of these crystals show retardations under the polarizing microscope of less than 100 $\mu\mu$ and are pale gold, or occasionally blue, by reflected light. Their thickness is of the order of 0.1 μ . Specimens examined by X-rays invariably show that the developed face is a (001) plane, and this contains the a - and b -crystal axes which are mutually perpendicular. The positions of the b -axis were found either by means of X-rays or microscopy, and the crystal mounted on a rotating stage with its face perpendicular to the optic axis of a Hilger Littrow quartz spectrograph. Light passed through the crystal into a quartz Wollaston prism and on to the slit, the two beams of plane-polarized light being about 4 mm. apart. The optical densities for the two directions of polarization were measured by sector photometry against equally long exposures of the light source without the crystal. The ratio of these optical densities for electric vector directions parallel to the a and b crystal axes was compared with that calculated

from the known inclinations of molecular axes within the crystal.

The spectral range accessible to the quartz spectrograph includes three regions of absorption, each corresponding to a distinct band system of anthracene. In the systems at 3800 A. and 2700 A., absorption is greater for the electric vector parallel to the b -crystal axis; in the system at 2300 A. absorption is less for the b - and greater for the a -direction. These results cannot at once be put in terms of molecular axes, since three molecular axial directions cannot be characterized from two crystal directions. However, much evidence suggests the inactivity in transitions in the near ultra-violet of one of the molecular axes, namely, that normal to the plane of the rings; and if this inactivity be accepted, it follows from our results that the band system at 2700 A. is polarized along the shorter in-plane axis, that the system at 3800 A. has at least a strong component along this axis, and that the system at 2300 A. is polarized along the longer in-plane axis.

There is clear evidence in the 3800 A. band system of the displacement of the absorption maxima in a -polarization from those in b -polarization, so that the whole band system appears to be displaced as well as changed in intensity, as the polarization direction of the incident light changes in the ab face. The split maxima have separations in the range 50–100 cm^{-1} . This may be the phenomenon, a theory of which was first given by Davydov³, in which intermolecular forces split the molecular energy-levels into pairs of crystal states with different polarization properties.

These preliminary results will later be incorporated in a more complete report. We wish to acknowledge valuable discussions with Prof. C. K. Ingold. We have also received important help from Dr. H. G. Poole, who designed the optical arrangements, and from Mr. Philip Knight, who made several X-ray examinations of anthracene crystals and so made possible their correct orientation in the light beam.

D. P. CRAIG
P. C. HOBBS

University of Sydney, and
University College,
London, W.C.1.
Oct. 8.

¹ Obreimov, I. W., and Prikhotjko, A., *Sov. Phys.*, **1**, 203 (1932).

² Obreimov, I. W., and Prikhotjko, A., *Phys. Z. Sow.*, **9**, 34, 48 (1936).

³ Davydov, A. S., *J. Exp. and Theor. Phys. (U.S.S.R.)*, **18**, 210 (1948).

Estimation of the 9 : 10-Dihydroxystearic Acids and their Acyl Derivatives

THE occurrence of esters of 9 : 10-dihydroxystearic acid (melting point, 132°) among the autoxidation products of oleic and elaidic acids has been established by Ellis¹, who utilized the sparing solubility of the dihydroxy acid for its isolation and estimation. In the presence of a high proportion of oily products, however, a quantitative separation of the acid is sometimes difficult, and the presence of silica following prolonged alkaline hydrolysis may also be a source of error.

The method of estimation to be described takes advantage of the fact that, under suitable conditions, periodic acid oxidizes the 9 : 10-dihydroxystearic acids almost quantitatively to nonaldehyde and azelaic semialdehyde², of which the former may readily be isolated by distillation in steam and its