LETTERS TO THE EDITOR

REYNOLDS'S NUMBER AND LIQUID HELIUM II

The peculiar properties of liquid helium II which have been discovered in recent years have so far received no satisfactory explanation.* The remarkable feature of the flow of liquid helium II is the fact that it is almost independent of pressure.

If V denotes the volume-rate of flow through a capillary tube under an applied pressure difference p, then the different types of flow are distinguished by the value of n in the relation: $V = Ap^n$, where n is equal to 1 for Poiseuille's flow, ½ for turbulent flow and zero for He II flow. It is interesting to note that for the third type of flow, dimensional considerations require that the Reynolds number $u\rho D/\eta$ must remain constant, the value of this constant, of course, depending upon temperature. For this case, the velocity of flow will be inversely proportional to the diameter of the capillary tube and the volume-rate of flow will vary as the first power of the radius and not the fourth power which characterizes Poiseuille's flow.

It will be of interest to find out whether the flow of liquid helium II is really characterized by the constancy of Reynolds's number, and if such happens to be the case, it may well prove to be the simplest type of flow.

Baroda College, D. V. Gogate.
June 15, 1944.

* London, F., *J. Phys. Chem.*, 1939, p. 43.

OPTICAL CONSTANTS OF TUNGSTEN AND ANTIMONY DETERMINED BY REFLECTED POLARISED LIGHT

Experimental determination of optical constants of metals has received a quickening impulse as the result of the application of quantum mechanics to the metallic state. The present tendency has been firstly, to check the old data under improved experimental conditions; secondly, to investigate how far the polishing and contamination of surfaces are responsible for the variation in the values obtained by different workers; and thirdly, to supply the data for the metals which have not been thoroughly worked as yet. This note supplies the experimental data for Tungsten and Antimony and discusses the effect of polishing.

The experimental arrangement is that of Drude's[1] in which a beam of plane polarised light, when reflected from a metal surface, suffers a change in the state of polarisation. Locally constructed Half-shades, as suggested by L. Trontstad,[2] have been used for increasing the sensitiveness of the apparatus.

The literature on the subject[3] shows that the data for Tungsten and Antimony are few and very old. We have determined these for the range 4600 Å to 6600 Å at intervals of 200 Å and studied the variation dependent on polishing. Surfaces were prepared by taking massive metal which was rubbed flat against a file. Starting with the coarse emery paper, spread on a flat glass surface, it was ground in a particular direction so that all scratches developed in that direction only. With the next finer emery paper it was ground in a direction at right angles to the previous one. This process was continued till the finest emery paper was reached. These last fine scratches were removed by rubbing it on a pad of old cloth covered with a paste of finely powdered aluminium oxide and held against a flat glass surface. Alternate use of magnesium oxide was also made. This process of slow hand-polishing was continued till scratches were removed. Finally, the surface was washed with soap-solution and then with alcohol to remove any trace of grease. First set of observations were made on lightly polished metallic surfaces. Same surfaces were further polished and measurements were repeated. Representative values from two such sets of measurements have been denoted by (A) and (B) respectively in Tables I and II.

TABLE I
Data for Tungsten

Wave-length in Å	nk (A)	nk (B)	n^2k (A)	n^2k (B)
6600	3·59	3·80	11·4	10·4
5600	3·12	3·49	7·23	9 22
4600	3·51	3·34	9·59	8·06

TABLE II
Data for Antimony

Wave-length in Å	nk (A)	nk (B)	n^2k (A)	n^2k (B)
6600	4·94	4·61	4·10	11·2
5600	4·06	3 88	2 69	5·16
4600	3·30	3·14	1·86	2·97

Mott[4] has concluded, after a comparison of the results of Minor, Tool and Lowery, that the crystalline metal absorbs less strongly than the amorphous polished layer. Heavier polishing produces thicker amorphous layer and consequently absorption is greater as is indicated by the increased value of n^2k. It has been further pointed out[5] that in the case of copper, as given by Lowery, nk is less sensitive to the method of polishing than n^2k (Mott uses the notations nK and K for Drude's n^2k and nk respectively). In the case of antimony exactly similar results have been obtained by us. In the case of tungsten also this tendency is clearly manifested for the majority of wavelengths, with the only difference that the lightly polished surface gave a minimum value for n^2k at 5400 Å which disappeared with the heavier polish.

Physics Department,
Science College,
Patna,
April 25, 1944.

L. M. CHATTERJEE.
K. N. PRASAD.

1. Wood, *Physical Optics*, 3rd Ed., 1934, page 542. 2. Tronstad, L., *Jour. of Scientific Instruments*, 1934, **11**, 144. 3. International Critical Tables, 1929, Ed., **5**, 248: *Landolt-Bornstein Physikalisch-Chemische Tabellen* 1923 Ed., 903. *Ibid.*, Erster *Erganzungsband*: 1927 Ed., 463. Seitz, F., *The Modern Theory of Solids*, 1940 Ed., 656. 4. Mott, N. F. and Jones, H., *The Theory of the Properties of Metals and Alloys*, 1936 Ed., 117. 5. —, *Ibid.*, 121.

A PRELIMINARY NOTE ON THE APPLICATION OF ABSORPTION-SPECTROSCOPY TO TIMBER WOOD EXTRACTS

LAST December (1943) during the War Services Exhibition held at Nagpur, a conversazione was arranged by the local Science College. There we witnessed certain interesting demonstrations on Spectroscopy, Raman Effect, and Irradiation of Chemical Substances under cathode rays, etc. It then occurred to us why we should not employ spectroscopy for the elucidation of our problem, namely, that of the Identification of Timber Woods.

The problem was discussed with Dr. A. S. Ganesan of the Physics Department of the Science College (Nagpur) and he very kindly offered to take spectrographs of the absorption-spectra of iron in relation to water extract of timber woods.

We then approached Mr. Haji Fazal, a well-known furniture-maker and timber merchant of Nagpur, and he very kindly placed at our disposal for experiment the following four important timber woods commonly employed in the manufacture of funrniture:—

(1) *Bija* or *Bijasaal* (*Pterocarpus marsupium* Roxb. (Leguminosæ).
(2) *Sagwan* or Teak (*Tectona grandis* Linn.) (Verbenaceæ).
(3) *Siwan* (*Gmelina orborea* Roxb.) (Verbenaceæ).
(4) *Salai* (*Boswellia serrata* Roxb.) (Burseraceæ).

Thin fine shavings of each of the specimens aforesaid were taken off by planing. Equal quantities of these were separately boiled in equal volume of tap-water for fifteen minutes each, in glass beakers and they were subsequently allowed to cool down. Thereafter each one of them was separately filtered through fresh filter-paper and the filtrate collected in glass beakers. The tap-water, being the mother-liquor in each case, was, therefore, taken separately and was marked as Control. We had thus five samples of liquids for our experiment.

These five liquids (including the tap-water) were subjected to spectroscopic examination and spectrograph of their absorption-spectrum was taken in an arc light emitted from iron electrodes. The spectrograph as seen in the text-figure is the result and it shows the following:—

(*a*) Fe: The spectrum of iron.
(*b*) Control: The spectrum of iron through tap-water.