As in our previous investigations, we used the oscillating disk method, with very small plate distances. Considering the results obtained for light hydrogen ($T = 293°$ K., $\eta \times 10^7 = 882{\cdot}7$; 89·4°, 387·1; 77·3°, 345·8; 20·3°, 108·8; 18·5°, 102·4; 16·7°, 90·3; 15·1°, 80·8; 14·1°, 74·5), it will be observed that our results are in good agreement with the results obtained by Kamerlingh Onnes, Dorsman and Weber[4] and by Sutherland and Maass[5]. The values published recently by Keesom and Macwood[6] for the viscosity of light hydrogen at liquid hydrogen temperatures are about 20 per cent higher. On the other hand, the values obtained by Vogel[7] and Günther[8] are about 10 per cent smaller than our values and those of Kamerlingh Onnes, Dorsman and Weber.

From our measurements on the two kinds of hydrogen, we determined the ratio η_{D_2}/η_{H_2} as a function of temperature. So we obtained at $T = 293°$ K., $\eta_{D_2}/\eta_{H_2} = 1{\cdot}39$; 90°, 1·34; 80°, 1·35; 75°, 1·35; 20°, 1·24; 17°, 1·24; 15°, 1·24; 14°, 1·25.

Thus at room temperature the ratio η_{D_2}/η_{H_2} is in good agreement with the ratio of the square root of the molecular masses of the two molecules. At lower temperatures there is a regular decrease in this ratio. This decrease cannot be attributed to the presence of a small per cent of H_2- in the D_2-gas.

More details on these measurements will be published shortly.

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Absorption of Gases by Tantalum

Hydrogen. A number of workers have measured the absorption of hydrogen by tantalum; thus Pirani[1] found a large absorption at yellow heat, Moers[2] measured the quantity taken up at higher temperatures, while Fetkenheuer[3] found a maximum in the absorption at about 600° C. On the other hand, Sieverts showed a curve[4] in which the quantity taken up was greater at 20° C. than at higher temperatures. The clean-up at low pressures does not appear to have been discussed in detail, although Balke stated[5] that below 1 micron the clean-up was very small.

We have studied the clean-up of hydrogen at pressures from 1 micron to 30 microns on a tantalum strip of area 2 cm.^{2} and mass 50 mgm. If the strip was degassed at temperatures below 1,500° C., surface oxide remained present. In this state the clean-up was as found by Fetkenheuer[3]. It was negligible below 400° C., reached a maximum at 600° C., and decreased again, becoming very small at 1,000° C. The absorption at 600° with a pressure of 1 micron was only about ½ cu. mm. measured at S.T.P. If, however, the strip was run in a very high vacuum for a long period at 1,900° C. or for a short period at 2,200° C., further gas was evolved, the strip became cleaner in appearance, and the clean-up of hydrogen was profoundly modified. The maximum absorption now occurred at 20° C. as found by Sieverts[4], while there was a continuous decrease in absorption from 100° C. to 1,000° C. as in Sieverts' curve. The clean-up was very rapid, the total quantity cleaned up at 1 micron pressure and 20° C. being about 20 cu. mm. measured at S.T.P. The clean-up was proportional to $\sqrt{P}$ from 1 micron to 30 microns; if proportionality continued to atmospheric pressure, the absorption at that pressure would be 17·5 c.c. If this is expressed in c.c. of hydrogen per gm. of tantalum, the figure is 350 c.c./gm., which is about seven times Sieverts' figure. It is probable, however, that saturation occurs below atmospheric pressure. All the gas cleaned up at 20° C. was liberated again at 950–1,000° C., and was partially liberated at lower temperatures.

Above 1,200° C., absorption appeared to increase again, although measurement was difficult on account of the rapid formation of atomic hydrogen at the higher temperatures. There appeared to be an increase to about 1,700° C., and a decrease above, absorption becoming negligible above 1,900° C. The maximum absorption was, however, much less than that at 20° C.

Exposure of the strip at room temperature to small pressures of oxygen restored the first type of behaviour. Exposure at 600° to oxygen led to this type of behaviour in a more marked degree, with a very small clean-up of hydrogen at 600°. Prolonged running at 2,200° C. was then necessary to restore the second type of behaviour.

Nitrogen. Variable results have also been obtained on absorption of nitrogen by tantalum[6,7]. We have found that after running at 2,100° C. in high vacuum, clean-up of nitrogen at 1 micron appears at 700° C., and is very rapid at 1,000° C.; it remains constant from 1,000° to 1,500° C., and decreases at higher temperatures. All the gas cleaned up at 1,000° is liberated at 2,100° C. and is partially liberated above 1,900° C. The absorption at 1,000° C. was not determined exactly, but was certainly greater than 25 c. mm. measured at S.T.P. when the pressure was 3 microns.

A strip in the oxidized condition after degassing at 1,500° only showed no absorption of nitrogen below 850° C., while absorption only became rapid above 1,200°. This result is that obtained by Moissan[7]. Thus in the case of both hydrogen and nitrogen, the earlier variable results have been due to contamination of the tantalum surface by oxide. Similar degassing treatments were found necessary in work on the thermionic and photo-electric properties[8,9].

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