



Fig. 2

(frequency = 500.0 kc./s.) as a function of pressure and temperature (liquid oxygen temperatures) in normal- and para-hydrogen and helium gas.

A comparison between the absorption coefficient for the two modifications of hydrogen at liquid-oxygen temperatures, where the velocity is approximately the same, can be considered as a direct control of the influence of the rotational energy on the absorption coefficient.

A plot of our measurements for the case of normal- and para-hydrogen is given in Fig. 1, whereby α_{obs} is plotted against $1/p$. From this graph, α , is practically zero. The classical absorption coefficient has also been plotted on this graph.

In Fig. 2 are shown the experimental results (full line) for helium gas at the boiling point of liquid oxygen. The theoretical absorption coefficient (broken line), computed from the experimental data for the heat conductivity, the viscosity coefficient and the specific heat published in "Helium" by W. H. Keesom (Elsevier, Amsterdam, 1942) is also shown. The agreement of the two curves is quite good, notwithstanding that the measurements are very difficult because of the small value of the absorption coefficient of helium.

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Life-time of Potassium Ions on a Tungsten Filament at 1,460° K.

EXPERIMENTS are proceeding at the University of Birmingham using high-speed rotors as sources of molecular beams¹. Using this technique, it was possible to produce a pulsed beam of potassium atoms, which was employed to measure the life-time of potassium ions on a hot tungsten filament.

The rotor consisted of a steel rod, tapered at both ends, spinning about its short axis. Each arm of the rotor terminated in a small cup, which was filled with potassium. The rotor was accelerated to 1,500 c.p.s. *in vacuo* by means of a rotating magnetic field. The heating of the rotor by eddy-current losses

resulted in the evaporation of the potassium. Pulses of potassium atoms were received by a tungsten filament placed in a tube situated at a tangent to the path swept by the rotor tips.

Potassium evaporates from a hot tungsten surface as positive potassium ions. This results from the fact that the electron work function of a tungsten surface is greater than the ionization potential of potassium. Thus pulses of potassium atoms incident on the hot tungsten filament resulted in pulses of potassium ions being received at a cathode partially surrounding the fila-

ment. These pulses were recorded by means of an amplifier and a cathode ray oscillograph.

The principal time constants which affected the observed pulses were thermal and electrical. The thermal time constant resulted from the fact that the potassium ions did not leave the filament instantaneously, but with a speed proportional to the concentration of potassium ions on the filament. The electrical time constant resulted from the resistance and capacity at the amplifier input.

Pulses were obtained with a thermal time constant corresponding to a filament temperature T and a negligible electrical time constant. Pulses of identical size and shape were obtained with a negligible thermal time constant (filament temperature 1,900° K.) by increasing the electrical time constant to a value CR by means of a variable capacity. Under these conditions, it is easy to show that the thermal time constant at temperature T is equal to CR . By this method the time constant for the emission of positive ions from a tungsten surface at a temperature of 1,460° K. was found to be 3×10^{-6} sec.

The temperature of the filament was deduced from its mass, length and heating current, using Jones and Langmuir's tables². The potential across the filament was also measured, and provided an independent determination of the temperature.

The evaporation of potassium ions from a hot tungsten surface has been studied by Moon and Oliphant³ and by Evans⁴. These investigations were conducted at surface temperatures of about 1,000° K. and showed that the decay of a deposit of potassium upon a hot tungsten surface was exponential. Their results demonstrated that the reciprocal of the time constant was proportional to $\exp(-\phi/KT)$, where K is Boltzmann's constant, T is the absolute temperature, and ϕ is the work function of the surface for potassium ions.

The measurement described in this communication agrees with an extrapolation of Evans's results, from which he deduced a value of ϕ equal to 2.4₃ eV. The concentrations of potassium upon the tungsten surfaces were well below monomolecular in both Evans's and our own experiments.

We are grateful to Prof. P. B. Moon for suggesting this application of our technique.

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Jan. 12.

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