VII. PHYSICAL ELECTRONICS AND SURFACE PHYSICS*

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A. DEPENDENCE OF PHOTOEMISSION FROM TUNGSTEN ON SURFACE TEMPERATURE AND RADIATION FREQUENCY

This report gives a summary of a thesis submitted by P. B. Sun to the Department of Mechanical Engineering, M. I. T., May 1965, in partial fulfillment of the requirements for the degree of Master of Science.

The temperature dependence of photoemission from a polycrystalline tungsten ribbon has been determined experimentally in the temperature range 300°K-2200°K. Temperatures from 1450°K to 2200°K were determined by a micro-optical pyrometer and corrected by the emissivity of tungsten at various temperatures. A mercury lamp (Bausch and Lomb HP-100) and sharp cut filters (Corning Glass) were used to obtain radiation at various frequencies and bandwidths. Both thermionic and photoelectric current were measured with a Keithley microammeter (Model 150A) with zero suppression capabilities of 100 times the total current.

The experimental results at low temperatures agree well with the Fowler theory.[1] At temperatures higher than 1900°K the photocurrent increases markedly with temperature, the form being exp(const/kT) for all radiation frequencies. Although the Fowler theory predicts this result for radiation frequencies lower than the threshold frequency, it does not predict the behavior observed here for frequencies higher or equal to the threshold frequency. The quantum yield at 2200°K is of the order of 10^{-3} electrons per quantum for all frequencies.

We are now attempting to interpret these data theoretically. The experimental program will continue after we improve the monochromator and tube designs.

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References

1. R. H. Fowler, Phys. Rev. 38, 45 (1931).