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The Emission of Electrons from Hot Silicon Surfaces

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The emission of electrons from hot silicon surfaces is reviewed in an effort to present a summary of the state of research in this field. The theoretical aspect of the problem is outlined briefly, and experimental results covering the temperature and field dependence of the saturation current density, as well as the anisotropy and the energy distribution of the emission are presented.

Ce travail donne un résumé de l'état actuel des recherches dans le domaine de l'émission thermique des électrons par des surfaces de silicium. L'aspect théorique est exposé succintement tandis que des résultats expérimentaux sont présentés. Ceux-ci concernent la dépendance de la densité du courant de saturation en fonction de la température et du champ, ainsi que l'anisotropie et la répartition énergétique de l'émission.

Die Arbeit gibt einen Überblick über den derzeitigen Stand der Forschung auf dem Gebiete der Thermoemission aus Silizium. Dem kurzen Abriß über den theoretischen Aspekt des Problems folgen die experimentellen Resultate über Temperatur- und Feldabhängigkeit der Sättigungsstromdichte sowie über Anisotropie und Energieverteilung des Emissionsstromes.

I. Introduction

The emission of electrons from hot semiconductor surfaces has been the subject of many investigations ever since the discovery by WEHNELT [*1*, *2*] in 1903 that the emission of electrons from metallic surfaces is many times enhanced by a coating of alkali neearth oxides. The oxide-coated cathode subsequently reached technical prominence, and it is not surprising that the bulk of the investigations was limited to the study of its properties.

Initially, interpretation was based upon largely superficial models until the results were re-examined within the percepts of modern semiconductor theory formulated by WILSON [*3*] in 1931.

A large measure of coherency was subsequently introduced to the field by the study of the properties of single-crystal barium oxide initiated at Cornell University by SPROULL, TYLER, DASH, PELL and KANE, in the late forties. But in spite of over six decades of research, many problems related to thermionic emission from oxide cathodes yet remain unresolved. This becomes particularly plain when comparison is made with the simultaneous progress in refractory metal emission research.

One of the difficulties is, of course, that the oxide emitter, in its commercial form, cannot really be classified as a semiconductor cathode. It should, much