



S O L I D S T A T E P A R T I C L E C O U N T E R

(An investigation into the use of aluminium
oxide as an alpha particle detecting medium)

by

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This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except when due reference is made in the text of the thesis.

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SUMMARY

An investigation was conducted into the use of aluminium oxide films and a single crystal as detecting media for alpha particles.

Existing detection methods and their limitations are discussed and reasons for investigating aluminium oxide stated.

Methods of preparing the oxide by anodisation, evaporation and cathodic oxidation are reviewed, and the known electrical properties of each type summarised.

Spark cutting and electropolishing equipment was developed and is described together with the other measuring equipment used.

Electrical conduction in the oxide is considered from a theoretical viewpoint and in the process values of the electron mobility are calculated.

Experimentally, the conduction mechanism in the films is shown to involve field enhanced thermionic emission of trapped electrons into the conduction band, although some evaporated films exhibited negative resistance characteristics.

Anodic and evaporated films did not respond to alpha particles, whilst cathodic oxide films thicker than 3500 Å produced measurable pulses when irradiated.

The oxide single crystal behaved as a detector when two adjacent electrodes were deposited on one face. From the pulse height and rise time a carrier mobility of $5 \pm 2 \text{ cm}^2 \text{ V}^{-1} \text{ sec}^{-1}$ and a carrier trapping time of $4.5 \times 10^{-7} \text{ sec}$ were calculated.

Possible future work is indicated.