

UNIVERSITY OF ADELAIDE

PHYSICS DEPARTMENT



THESIS FOR THE DEGREE OF MASTER OF SCIENCE

INFRARED ABSORPTION IN THIN METALLIC FILMS

K.C. Liddiard, B.Sc. (Hons)
Research Scientist
Australian Defence Scientific Service

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SUMMARY

This thesis describes research studies on the absorption of infrared radiation in thin metallic films. Thin films of nickel, gold and a nickel-chromium alloy were vacuum deposited on to freely-supported polymer membrane substrates. It is intended that these films will comprise the radiation receiver element of high performance infrared detectors.

The research is broadly divided into two main areas of study. These are the infrared optical properties of the selected metal films, and thermal properties relevant to the absorption process such as temperature rise, thermal rise time and thermal spread in the plane of the film. The thermal characteristics are of fundamental importance in infrared detector research, because they determine sensitivity, speed of response and optical image quality.

The first part of the thesis is concerned with a theoretical analysis of the thermal and infrared optical properties of metallic absorber films, and includes a resume of nucleation and growth phenomenon in vacuum deposited metal films. This is followed by a description of measurement techniques and the apparatus used for the preparation of metal films, and then a detailed discussion of experimental results. Careful consideration was given to the influence of deposition parameters, and a study was made of the structure of the films using conventional bright field electron microscopy. Finally, the experimental results are compared with theoretical predictions.

In general, good agreement was found between the theoretical analysis and the measured optical and thermal properties of the selected metal absorber films. This encouraging result enables us to predict the most suitable metal, and the optimum deposition parameters, to satisfy specific requirements in infrared detector research.

STATEMENT

I herewith state that this thesis does not contain any material which has been accepted for the award of any other degree or diploma in any University and that, to the best of my knowledge and belief, the thesis contains no material previously published or written by any other person, except when due reference is made in the text of the thesis.