Ain Shams University
Faculty of Education
Physics Department

Study of Structural and Mechanical Properties of Al-5356 Solder Alloy

Thesis

Submitted for
the Degree of Doctor of Philosophy for the Teacher's Preparation in Science (Physics)

By

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To

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ABSTRACT

Name : Essam Mohammed Nassr El Den

Title : Study of Structural and Mechanical Properties of Al-5356 Solder Alloy

Submitted to : Physics Department, Faculty of Education, Ain Shams University.

The present work is devoted to investigate:

(1) The effect of grain diameter and deformation temperature on the stress-strain characteristics of Al-5356 wire samples under constant strain rate (S.R) of $1.5x10^{-3}$ s^{-1}.

(2) The effect of ageing time on the stress-strain characteristics of Al-5356 wire samples strained at different deformation temperatures ranging from 303 to 523 K under constant strain rate of $1.5x10^{-3}$ s^{-1}.

(3) The effect of γ-irradiation with different doses (D) ranging from 500 to 2000 kGy on the stress-strain characteristics of Al-5356 samples strained by strain rate of $1.5x10^{-3}$ s^{-1}at different deformation temperatures (T_w).

(4) The structural changes accompanying both grain growth and ageing processes using optical and scanning electron microscopy (SEM) in addition to the energy dispersive X-ray spectroscopy (EDS) and X-ray diffraction (XRD) investigations.

In view of the microstructure and subsequently the stress-strain parameters variation, the obtained results showed that:

a) Increasing grain diameter of the tested sample resulted in decreasing the work-hardening parameters (WHP) yield stress σ_y, fracture stress σ_f, total strain ε_T and work-hardening coefficient χ_p.

b) Serration amplitude was found to be inversely proportional to the increase in grain diameter.

c) The total strain ε_T decreased with increasing the grain diameter while increasing the deformation temperature exhibited minimum value at 348K.

d) The WHPs σ_y, σ_f and χ_p increased with increasing the ageing time, while ε_T decreased.

e) The WHPs σ_y, σ_f and χ_p increased with increasing the irradiation dose D, while ε_T decreased.

f) The Deformation temperature exhibited a reverse effect of γ-irradiation.

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CONTENTS

CONTENTS

CHAPTER II

EXPERIMENTAL TECHNIQUES AND DEVICES

CHAPTER IV

DISCUSSION

CONTENTS

List of Equations

List of Figures

Figure	Caption	Page