بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

HANAA ALY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

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HANAA ALY

STUDY OF THERMO-MECHANICAL TREATMENT AND MN, TI ADDITIONS OF CU-AL-NI SHAPE MEMORY ALLOYS

By
Khaled Ahmed Amin Abdelghafar

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Metallurgical Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Title of Thesis:

STUDY OF THERMO-MECHANICAL TREATMENT AND Mn, Ti ADDITIONS OF Cu-Al-Ni SHAPE MEMORY ALLOYS

Key Words:
Shape memory alloy; martensitic transformation; austenite; solution treatment; X-Phase.

Summary:

There is no comprehensive study on the combined effect of both thermomechanical treatment and modification with alloying elements on the shape memory properties of Cu-Al-Ni shape memory alloy (SMAs).

Therefore, this work aimed at studying the effect of 85% thickness reduction through hot deformation as well as heat treatment on the martensitic transformation of Cu-Al-Ni-Ti-Mn SMAs. The samples were divided into two groups: the first group was solution treated at 900°C for 30 min. (S.T), and the other group was hot-rolled at 900°C followed by solution treatment at 900°C for 30 min. (H.R.S.T). The results showed that the hardness of the samples decreased with increasing the percent of Ni. The DSC investigations revealed that the martensite start temperature (Ms) decreased due to the addition of both Ti and Mn compared to the predicted Ms reported in the literature.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the reference section.

Name: Khaled Ahmed Amin Abdelghafar Date: / /2021.

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Nomenclature

SEM	Scanning Electron Microscopy
OM	Optical Metallography
EDS	Energy Dispersive X-Ray Spectroscopy
DSC	Differential Scanning Calorimetry
SMA	Shape Memory Alloy
SME	Shape Memory Effect
18R	Monoclinic Martensite
2H	Hexagonal Martensite
B2	Ordered Body Center Cubic.
$L2_1$	F.C.C superlattice structure
DO_3	Ordered Austenite
A_s	Austenite Start Temperature
A_f	Austenite finish Temperature
M_s	Martensite Start Temperature
M_f	Martensite finish Temperature
VHN	Vickers Hardness Number