

Northern Technical University / Dour Technical Institute /Mechanical Techniques
Department



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Nahrain	Ph.D	2020	Mechanical engineering-applied mechanics	Iraq

Teaching experience

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Research and scientific activity

1. An Experimental Investigation on Fatigue Properties of AA3003-H14 Aluminum alloy Friction Stir Welds 2. The Optimization Conditions of Friction Stir Welding (FSW) for Different Rotational and Weld speeds 3. https://scholar.google.com/citations?view_op=view_citation&hl=ar&user=MEPptFcAAAAJ&citation_for_view=ME	
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Scientific and research interests:

Biomechanic materials, metal production Honours and Awards

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The Effect of Heat Treatment Conditions on the Mechanical Behavior of Ni-Ti Shape Memory Alloys

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Abstract. Ni-Ti shape memory alloy (SMA), and its alloys have been widely used for medical, mechanical and electrical applications. In this study, a (Nitinol) Ni-Ti alloy medical plate was prepared and cut using a wire cut machine. Eight samples were heat treated at 800 °C and used for heating samples for 30 min and 60 min at this temperature, then cooled in four media: furnace, water, air, and ice bath. Micro-hardness and microstructure measurements were taken, to characterize the effect of cooling rate on mechanical properties. Micro-hardness results showed the HV is 316.36 HV at ice cooling rate for 800 °C and 60 min heating time, and 275.5 HV for 800 °C heating for 30 min and ice cooling media. The results show the correlation between cooling rate and properties of the alloy.

Key words: SMA, Ni-Ti, Nitinol, microstructure, Micro-hardness

1. Introduction

The Nickel-Titanium alloy was first developed in the 1960s. It was named Nitinol, an acronym for the elements from which the material was composed, (Ni for Nickel and Ti for Titanium) and the location for these investigations, (nol, from the Naval Ordnance Laboratory).

Based on the equiatomic, intermetallic compound Ni-Ti, the alloy composition used for the manufacture of Ni-Ti instruments is about 55% nickel and 45% titanium (wt.%) [1]. Shape memory alloys (SMAs) have been widely utilized for their excellent functional properties and high magnitude of actuation energy density. Of the various SMAs, nickel-titanium (Ni-Ti) has the optimal combination of properties including a high percentage of shape recovery, recovery stress and super-elastic strain. However, the limitations of traditional manufacturing techniques and the poor machinability of Ni-Ti have critically restricted the application of its full potential [2].

The SMAs have been found useful in many areas due to their high power density, solid state actuation, high damping capacity, durability and fatigue resistance when integrated with civil structures [3]. It is well known that the Ni or Ti content in a Ni-Ti SMA affects the phase transition temperatures, and that increase of Ni content in Ni-Ti shape memory alloys induces a decrease in Ms [4]. Chemical composition and heat treatment temperature and the time for annealing will influence the super-elasticity and the shape effect of the Ni-Ti shape memory alloy, so their use may enhance the shape memory alloy's attributes [5].

In light of this, the present study was conducted to impose multiple heat treatments upon a Ni-Ti alloy at different heating rates and for different cooling media. Hardness and microstructure were examined to assess the extent of heat treatment effects and results were gathered concerning heat time, value and cooling rate.

2. Experimental procedures

The experimental procedures comprised the following steps:

1. The plate of Ni-Ti was prepared by wire cut machine.

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Research Interest  0.4

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