ABSTRACT

Nickel –Titanium – Copper shape memory alloys be appropriate to the group of smart efficient materials due to their rare properties such as shape memory effect and superelasticity and thus provide a high advance in the biomedical area.

The structural, physical and corrosion properties of nickel–titanium–copper shape-memory alloy were investigated in this study. The alloy was prepared through the powder metallurgy method. Powders of 50% Ti, 46% Ni, and 4% Cu by weight then were mixed and cold-compacted at 600, 700, and 800 MPa to form cylindrical samples 11 mm in diameter and 16.5 mm in length. After compaction, samples had sufficient green strength for handling then were sintered at 850 °C, 900 °C, and 950 °C for five hours in an electric vacuum tube furnace.

The optimum compacting pressure and sintering temperature were identified using Taguchi design L9. Samples prepared under the optimum process conditions were then irradiated using a pulsed Nd: YAG laser at 300, 400, 500, and 600mJ with pulse duration 300msec and spot diameter 11mm.

The main object of this study is to optimize the effect of shape memory of Ni-Ti-Cu alloy using taguchi design, then manufacturing the optimum sample and testing it to verify the obtained result and Study the effect of different laser energy values on the corrosion rate for Ni-Ti-Cu alloy also its effect on the surface and structural properties.

The effects of laser treatments were investigated through optical microscopy, scanning electron microscopy, energy dispersive spectroscopy, X-ray diffraction, microhardness test, and corrosion test using hank solution (pH =7.4). ii

The results revealed that laser irradiation at 500 mJ enhanced the surface properties of the Ni-Ti shape-memory alloy with little corrosion rate (8.3mpy) alloy and hardness increased from 204 HV to 455.2HV. However, laser irradiation at 650 mJ damaged the surface of the alloy.