ABSTRACT

In the present work, the cooling rate effect on the precipitates kinetic and stress induced phase transformation behavior of Ni-rich NiTi alloy has been investigated. The NiTi specimens were given heat treatment at 800°C for 1h and 2h under vacuum in a high temperature furnace followed by their quenching in the air, water and ice. X-ray diffraction (XRD), Scanning electron microscope (SEM) and tensile test are performed to understand the cooling rate effects on phase transformation and precipitates kinetic. XRD patterns revealed the formation of Ni_4Ti_3 and Ni_3Ti precipitates in all the heat treated specimens. The diffraction peaks intensities of these precipitates were found to increase by increasing the annealing time from 1h to 2h in all the quenching media, however, the peak intensities of these precipitates were significantly decreased by rapidly quenching the specimens in the ice medium. The formation of these precipitates was associated with a decrease in the Ni contents in NiTi matrix. SEM results also indicated the existence of the needle shaped precipitates on the surface whose size was found to increase by increasing the annealing time from 1h to 2h. However, by changing the quenching medium from air to water and then to ice, the precipitates size was decreased. The formation of small cracks was also noticed in the ice quenched NiTi specimens. The tensile stress-strain curves obtained using the UTM showed the existence of rohmbohedral (R) phase in all the specimens, however, by increasing the annealing time from 1h to 2h, the stress induced phase transformation and the plateau strain were decreased. The transformation stresses and plateau strain were further decreased by increasing the cooling rate of the specimens. i.e. the specimens quenched in the ice quenched displayed less plateau strain as compared to those quenched in the water and the air. These changes were attributed to inhomogeneity in the Ni contents due to the formation and

changes in the shape and density of Ni_4Ti_3 and Ni_3Ti precipitates in the thermally treated in NiTi alloy.