Thesis Title	Fabrication and Development of TiNi – Based High Temperature Shape Memory Alloys for Sensor Applications
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Candidate	Mr. Taywin Buasri
Thesis Advisors	Asst. Prof. Dr. Anak Khantachawana
	Dr. Sarawan Wongsa
Program	Master of Engineering
Field of Study	Mechanical Engineering
Department	Mechanical Engineering
Faculty	Engineering
B.E.	2555

Abstract

This research aimed to fabricate and develop TiNi – Based High Temperature Shape Memory Alloys (HTSMA) with good pseudoelasticity and good creep resistance in high temperature range. The research also focused on the feasibility studies of the application of these alloys as a sensor in high temperature range. In order to investigate such a potential, nominal compositions of $Ti_{50}Ni_{26}Au_{24}$ (at %), $Ti_{50}Ni_{15}Au_{35}$ (at %), $Ti_{50}Ni_{20}Pd_{30}$ (at %), $Ti_{50}Ni_{12}Pd_{38}$ (at %), $Ti_{50}Ni_{28}Pt_{22}$ (at %) and $Ti_{50}Ni_{23}Pt_{27}$ (at %) were used. The alloys were fabricated by a vacuum arc melting technique. The specimens were cold rolled at 20% reduction in thickness and subsequently annealed at various temperatures. Transformation temperatures were detected by differential scanning calorimetry (DSC). Oxidation tests at 600ºC were carried out in order to evaluate the oxidation resistance. Cyclic tests were carried out at a temperature range of 240 – 540ºC in order to confirm pseudoelasticity. Creep tests under constant stress at 240ºC were also carried out in order to evaluate the creep resistance. In addition, the possibility for the application of TiNi – based HTSMAs as a sensor at high temperatures was investigated. The behavior of electrical resistance and strain were measured under cyclic test, which was used as the simulated crack propagation. The results show that $Ti_{50}Ni_{20}Pd_{30}$ (at %) and $Ti_{50}Ni_{28}Pt_{22}$ (at %) exhibit good pseudoelasticity under cyclic tests at 240ºC and 365ºC, respectively. Furthermore, these alloys also exhibit superior oxidation resistance and creep resistance. In this study, a HTSMA sensor with a precision of 0.42% strain was able to measure the strain up to 3.8% under cyclic test at 240ºC. The precision of this sensor can be obtained at a minimum strain of 0.42%.

Keywords : Pseudoelasticity / Strain Sensor / Stress – Induced Martensite / TiNi – Based High Temperature Shape Memory Alloys