FINAL REPORT
For Japan-Korea Joint Research Project

AREA	1. Mathematics & Physics 2. Chemistry & Material Science 3. Biology 4. Informatics & Mechatronics 5. Geo-Science & Space Science 6. Medical Science 7. Humanities & Social Sciences

1. Research Title:

Fabrication of Light-weight Porous Intermetallic Compounds with a High Specific Strength by Controlling the Microstructures

2. Term of Research: From 1. July. 2009 To 30. June. 2011

3. Total Budget

a. Financial Support by JSPS: Total amount: 2,400 thousand yen

1st Year 800 thousand yen 2nd Year 1,200 thousand yen

3rd Year 400 thousand yen

b. Other Financial Support : Total amount: 0 thousand yen

4. Project Organization

a. Japanese Principal Researcher	
Name	**Hideo Nakajima**
Institution / Department	**The Institute of Scientific and Industrial Research Osaka University**
Position	**Professor**
b. Korean Principal Researcher	
Name	**Mok-Soon Kim**
Institution / Department	**Inha University**
Position	**Professor**

c. List of Japanese-side]

(Except for Principal Researcher)

Name	Institution/Department	Position
Shinsuke Suzuki	The Institute of Scientific and Industrial Research, Osaka University	Associate Professor
Masakazu Tane	The Institute of Scientific and Industrial Research, Osaka University	Associate Professor
Ryusuke Nakamura	The Institute of Scicntific and Industrial Research, Osaka University	Assistant Professor
Takuya Ide	The Institute of Scientific and Industrial Research, Osaka University	Assistant Professor
Hiroshi Chiba	The Institute of Scientific and Industrial Research, Osaka University	Doctoral Course
Te-Bum Kim	The Institute of Scientific and Industrial Research, Osaka University	Doctoral Course
Yeong-Hwan Song	The Institute of Scientific and Industrial Research, Osaka University	Doctoral Course

d. List of Korean-side Participants (Except for Principal Researcher)

Name	Institution/Department	Position
Soong-Keun Hyun	Inha University	Associate Professor
A-Mi Yu	Inha University	Doctoral Course
Ji-Woon Lee	Inha University	Master's Course
Yoon-Soo Lee	Inha University	Master's Course

5. Number of Exchanges during the Final Fiscal Year*

a. from Japan to Korea

*Japanese fiscal year begins April 1.

Name	Home Institution	Duration	Host Institution
Hideo Nakajima	Osaka University	two days (H23.6.29-H23.6.30)	Inha University

For Final Fiscal Year(FY2011)	For Final Fiscal Year(FY2011)
Total: 1 persons	Total: 2 man-days

Numbers of Exchanges during the past fiscal years
FY2009: Total 3 persons FY2010: Total 5 persons

b. from Korea to Japan

Name	Home Institution	Duration	Host Institution

For Final Fiscal Year(FY2011)	For Final Fiscal Year(FY2011)
Total: 0 persons	Total: 0 man-days

Numbers of Exchanges during the past fiscal years
FY2009: Total 3 persons FY2010: Total 4 persons

6. Objective of Research

For the engineering structural applications, materials should have sufficient strength with ductility to be used. A number of intermetallic compounds exhibit brittle behavior at ambient temperature. This drawback for the engineering application should be improved. For the porous materials, which possess good energy absorption ability, the shortcomings would be possibly solved. Especially, from its unique microstructure, lotus-type porous metals, which have aligned cylindrical pores in the matrix, are in possession of superior mechanical properties to that of metals with spherical pores. In these point of view, lotus-type porous metals would be a promising materials for engineering structural applications when it comes to needs for the materials with sufficient strength and ductility.

The objective of this research is to investigate the mechanical properties of intermetallic compound and the effect of pores to the brittle metals at room temperature and high temperature. Furthermore, the acquisition of fundamental data for structural materials design using at high temperature is the purpose of this research based on intermetallic compound.

7. Methodology

Continuous zone melting technique was carried out to produce lotus rods in the hydrogen atmosphere of 2.5 MPa. Nonporous rods were produced by same technique in an argon atmosphere of 2.5 MPa to compare compressive behavior with lotus specimens when the raw ingots were melted and unidirectionally solidified. Transference velocity was 330 μm/s for both type of rods. The porosity of lotus NiAl was measured from the relative density. The pore diameter was determined with an image analysis software (Image-pro plus, Media Cybernetics Inc., Bethesda, MD).

Compression tests were carried out with universal testing machine with a strain rate of 1.1×10^{-3}/s at 298K(RT), 673K and 873K. Compressive specimens ($5 \times 5\times 7.5$ mm^3) were cut from prepared ingots by wire electro discharge machining (EDM). Compressive directions of specimens were parallel and perpendicular direction to the solidification direction. Specimens were homogenized for 24 hours at 1473K in vacuum of 8×10^{-4} Pa.

Optical microscope(OM, VHX) and scanning electron microscope(SEM, Jeol) were used to observe microstructure. Electron backscattered diffraction was used to confirm the orientation of NiAl phase.