B1-3
Development of manufacturing and application technologies of high-performance hydrogen storage alloys

The purpose of this study is to produce high-performance hydrogen storage alloys and develop design technology of storage modules for applications thereof. In order to accomplish this purpose, the following research will be performed:

- Research on enhancement of hydrogen storage properties of materials
- Development of hydrogen storage alloy production techniques
- Research on design technology development for MH tanks.

Goal

Demonstration of the production techniques for hydrogen storage alloys with well-controlled composition and structure, and establishment of the common numerical analysis techniques for optimized design of MH tanks.

- Demonstration of the production techniques for hydrogen storage alloys with well-controlled composition and structure
  - No less than tens of kg/batch scale, hydrogen storage density of no less than 120 kg H_2/m^3
- Development of materials for enhanced hydrogen storage properties and development of microstructure control techniques
- Development of hydrogen storage material with at least 3.0 wt%, 120 kg H_2/m^3 storage density
- Establishment of common numerical analysis techniques for optimized design of MH tanks
- Development of hydrogen storage module combining hydrogen storage alloy and MH tank

Objective

- 1st year
  - Establishment of production conditions for melting by VIM
  - Enhancement of hydrogen storage capacity: reversible storage capacity of at least 2.8 wt% at below 100℃
  - Investigation of charge/discharge properties of 1 kg-scale MH tank for development of reaction model
- 2nd Year
  - Establishment of conditions for melting production by VIM and Melt spinner
  - Enhancement of hydrogen storage capacity: reversible storage capacity of at least 2.9 wt% at below 100℃
  - Development of chemical reaction model of MH tank using material properties
- 3rd Year
  - Establishment of conditions for melting production by VIM, Melt spinner, Gas atomization
  - Derivation of optimized melting production techniques according to alloy species
  - Enhancement of hydrogen storage capacity: reversible storage capacity of at least 3.0 wt% at below 100℃
  - Design of MH tank by numerical modeling
- 4th Year
  - Demonstration of hydrogen storage alloy production techniques
  - Enhancement of hydrogen storage capacity: reversible storage capacity of at least 3.0 wt% at below 80℃
  - Establishment and verification of common numerical analysis techniques for MH tank design

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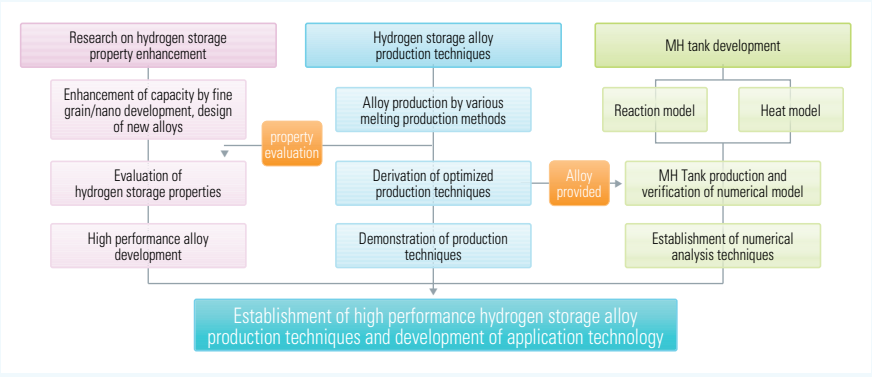
Strategy



Outcomes & benefits

- Application to industrial/HEV Ni-MH batteries, various off-board fuel cells, and on-board fuel cells for hybrid automobiles, submarines, ships etc. by procuring production techniques of hydrogen storage alloys which are emerging as a promising alternative for applications in various fields.
- MH tank design technology based on numerical analysis techniques allows for analysis and predictions for a wide variety of variables, allowing for application to MH tank design at relatively low costs.
- Promotion of latter application industries such as MH tanks and various fuel cells in addition of materials industry.
- Independence from technologically leading nations.
- Contribution to early realization of fuel cells and hydrogen economy.
- Procurement of melting technologies for highly reactive metals including hydrogen storage alloys.

Publications (2nd stage)

Patent		Theses							Proceedings		
		domestic			foreign			total sum			
domestic	foreign	SCI	Non SCI	sum	SCI	Non SCI	sum		domestic	foreign	sum
2/2			2	2	10		10	12	12	10	22

- Publications

1. Sung-Wook Cho et al. "Hydrogen absorption-desorption properties of $Ti_{0.32}Cr_{0.43}V_{0.25}$ alloy", Journal of Alloys and Compounds, 430 (2007) 136-141.
2. Jeong-Hyun Yoo et al. "Effects of desorption temperature and substitution of Fe for Cr on the hydrogen storage properties of $Ti_{0.32}Cr_{0.43}V_{0.25}$ alloy", Int. J. of Hydrogen Energy, 32 (2007) 2977-2981.


Ti-Cr-V-Fe Hydrogen Storage Alloy


MH tank utilizing high-performance hydrogen storage alloy (1.4kg)