International Conference for Next Generation Automobile

Materials for the Next Generation Automobile

Dr. Yasutaka IGUCHI

Chairman of the Board at Miyagi Organization for Industry Promotion
Professor Emeritus of Tohoku University &
Hachinohe National College of Technology
Special Adviser to the President at Hirosaki University

Research Backgrounds are High Temperature Physical Chemistry
on Iron & Steel, Slag & Flux, Silicon, Ceramics or Bio-materials

Technology Transfer from Universities to Industries

Intellectual Property Rights

October 8-10 2014
Sendai International

Iwaki Mt.
At Tohoku University here in Sendai, many researches on the highly advanced materials have been carried out for a long time after the establishment.

So, Sendai is call as “Makkah” on Materials Research.
Miyagi Organization for Industry Promotion

"flow of the support"

Small business

Support for consultation aimed at solving problems

Telephone & interview

Mechanism support menu

「growth, development」

Corporate revitalization
Business takeover

Management innovation and establishment

Funding

Trading, marketing expansion

Industry academia government collaboration

Human resource development

Facility provide

Agribusiness

Comprehensive consultation

Introduction of Miyagi prefecture, industry support organization
Guidance of various support system

Support for consultation aimed at solving problems
Climate Changes such as flood, heavy rain, heavy snow, storm, tornado and drought are caused by greenhouse gases, mainly carbon dioxide. United Nation held the climate change summit. IPCC: Intergovernmental Panel on climate change.

Therefore, fossil fuel should be reduced. I am afraid that the very severe regulation to emission of CO$_2$ will be established.
Target of Development of Next Generation Automobile

High Fuel Efficiency, High Mileage
Light Weight → Aluminum, Magnesium, Titanium
Carbon fiber reinforced plastics
Safety to Collision
↓
Super High tensile Strength Steel
Catalyst for Exhaust Gas
Workability of Corrosion Resistant Steel and Special Steel
High-tech Products Jointly Developed with Customers:

- **TS (MPa)**
  - Mild steel: 340–370
  - 440–590
  - 780–980
  - 1180

- **BH sheets**
- **DP, TRIP high-strength steel**
- **UHSS (980, 1180, 1310DP)**
- **Cold Rolled sheets for 1760 hot press**
- **Hot-rolled, high-hole expansionability, high-strength steel (590, 780)**

**Shading**
We launched applications ahead of the steel industry.

- **Sn-Zn coated sheets for fuel tanks**
- **GA-L treated sheets**
- **Steel pipes for 1780DIB**
- **High-strength steel for induction quenching**
- **Al & Zn-coated sheets for the 1470 hot press**
- **GA980DP**
- **HSS for brake disks and rims (590DP, 780)**

**Vehicle body**
- **Suspension**
- **Wheels**
The share of mixed constructions will increase in the future.

Multi-Material-Design

- **Steel-construction**
- **Frame based constructions**
- **Thick-roll**
- **Cast-technics**
- **Roll-profiling**
- **Profile-intense (Mg, Al)**
- **AL-Sheet intense**
- **Al-Cast-intense**
- **FKV-Parts**
- **FKV-Floor**
- **FKV-Roof**
- **Body in Black**
- **RTM / SMC Inner structure parts**
- **CFRP-construction**
- **Mixed constructions St/Al/Mg/CFRP**
Hydrogen Fuel Cell Car with minimized battery unit
Ultimate Candidate of Next Generation Automobile

Development of
- Conversion of Hydrocarbon to Hydrogen
- Catalyst and Removal of Carbon Dioxide
- Finally, hydrogen from water by solar energy
  “It is my dream”

Transportation of hydrogen to the station from the refinery.

Materials for Hydrogen Cylinder,
- Hydrogen Storage Materials
- Lithium Ion Battery
- High Efficient Motor
  - Permanent Magnet
  - Silicon-Steel (Electro-magnetic Steel)

Price, Mass Production
Concept: Contribution and reconstruction utilizing ultra-low core loss of Fe-based alloy: $\text{Fe}_{94.1}\text{Si}_{0.6}\text{B}_{1.7}\text{P}_{2.4}\text{Cu}_{1.2}$ (wt.%)

To expand the development of Tohoku’s material technology industry and to reconstruct from the Great East Japan Earthquake

Objectives:

1. Production
   - Molten Spinning
   - Atomizing
   - Hetero amor.
     - Powder
   - Hetero amor.
     - Ribbon
   - Hetero amor.
     - Hetero amor.

2. Processing
   - Co-based amorphous alloys
   - Fe-based amorphous alloys
   - Si steels
   - Permalloy
   - Ferrite
   - NdFeB

3. Practical Proof
   - Motors
   - Transformers
   - Magnetic parts

4. Contribution
   - Power-saving
     - Reduce in loss of electricity (from 3.4% to 1%)
     - Corresponding to Power Generations by 7 thermal power stations)
   - Reconstruction / Generation of Jobs through Venture (Materials development type)

Roadmap:

1. Creation of Initiative
   - In-Urban Facilities
   - Out-Urban Facilities
   - Introducing Sample Preparation-Awareness Area
   - Collaboration Forum

2. Fundamental Researches
   - Sample Preparations
   - Structure, properties Analysis and Simulation
   - Magnetic Theory
   - Phase Transformation

3. Practical Researches
   - Integrating Industries
     - Generating new ventures and research jobs

4. Goal
   - Creating Initiative in Tohoku Area
   - Output

New alloy: NANOMET®
Developed via Breakthrough the Common Sense of Soft Magnetic Materials

Ultra-low core loss, high $\mu'$, Nanocrystalline soft magnetic material NANOMET®

Saving Energy

120mm width