Strategic Regional Innovation Support Program by MEXT
(For Recovery from Tohoku Disaster)

Next-Generation Automobiles / Miyagi Area

Industry-Academia-Government Innovation for Next Generation Automobiles: Development of New Products and Systems from Research Activities of Universities

Project Overview

Published March, 2013

Tohoku Economic Federation Tohoku University
Miyagi Prefecture
The 77 Bank
Intelligent Cosmos Research Institute

To All People around the World,

We thank you very much for your enormous support and encouragement for our recovery and reconstruction in the areas devastated by the 2011 Tohoku Earthquake and Tsunami. Although we still experience many difficult days and have many problems, going through this hardship has also allowed us to find new ways to strengthen bonds that invigorate our attitude toward reconstruction and revival.

In this situation, the automotive industry has largely been considered a major center of economic opportunity because of its economic reach. All over the Tohoku region but especially in Miyagi prefecture, the expectation for the automotive industry is enormous. Emblematic of this expectation is the recent startup of the Toyota Motor Tohoku Corporation. Our project the "Strategic Regional Innovation Support Program" supported by MEXT (Ministry of Education, Culture, Sports, Science and Technology). The project kicked off in July 2012 in order to realize the reconstruction and revival of Tohoku by the development of new products and systems through the collaborative efforts of industry, academia and government. This collaboration is primarily based on the R&D activities at Tohoku University. As a research-oriented university, Tohoku University has been involved in a number of collaborative efforts with worldwide business but less so with local businesses. As one might assume, the importance of developing local businesses is of the highest order for the recovery and revival in Tohoku Regeon. We understand that this is not an easy task, Thus since June, we tried a wide variety of events: Research information session for local business people, over fifteen lectures for human resources development and training, more than forty laboratory tours for local business people, our researchers were invited to tour local companies, and poster presentations by all laboratories which joined in this project. These events broke down the borders separating the university from local businesses and as a result many collaborations have begun to bloom. In the next few years this project will be promoting and strengthening them in an effort to further contribute to Tohoku's recovery and revival.

The objective of the booklet "Project Overview 2013" is to introduce you various activities in the project and hope to promote not only national level but also international level collaborations for the next generation automobiles. We believe that such global/local collaborations are highly important and indispensable for the reconstruction and revival of the Tohoku Region through the progress of a variety of local business.

We thank you in advance for your understanding and collaborations.

Katsuto Nakatsuka, Director

Akira Miyamoto, Chief of Research Promotion Committee

Contact

Project Office

Division of Next-Generation-Automobiles
Intelligent Cosmos Research Institute, Ltd

Address:
Located in Miyagi Fukko Park, SONY Sendai Tech,
3-4-1 Sakuragi, Tagajo, Miyagi, JAPAN 985-8589

Phone : +81(JAPAN)-22-352-7462
Fax :+81(JAPAN)-22-352-7463

Research Promotion Committee

Miyamoto Lab, New Industry Creation Hatchery Center, Tohoku University

Address:
Ⅱ-403, 6-6-10, Aoba, Aramaki, Aoba, Sendai, Miyagi, JAPAN 980-8579
Phone: +81(JAPAN)-22-795-7233
Fax: +81(JAPAN) -22-795-7235
E-mail: c_innovation@aki.niche.tohoku.ac.jp

Official Website

www.miyagicar.com
Please check for updated information.

If you're interested in a specific research topic...

You're welcome to contact a research group directly. If you are not sure whom to contact, please contact the research promotion committee listed above.

2013 ELyT lab Workshop

Zao To-o-gatta, Japan,
February 17-20, 2013

Next Generation Automotives: Goal of the National Project in Japan

MIYAMOTO Akira
New Industry Creation Hatchery Center, Tohoku University
6-6-10 II-403 Aoba Aramaki Aoba-ku, Sendai 980-8579, Japan

Abstract : On the basis of the successful contributions of Tohoku University to world-wide/national level science and technology, we are expected to further contribute to the progress of local and regional society especially after the big-earthquake and tsunami on March 11, 2011. In collaboration with local government, bank, academy, local bureaus of central governments, local economic organizations etc, in the present national project, more than 40 most-advanced laboratories of Tohoku University challenge to a variety of important targets in the next generation automotives.

1. Introduction

Rapid progress of globalization in industry and economy has led to the increased importance of a variety of advanced academic activities in industrial research and developments. As one of the most active research universities, Tohoku University has contributed significantly to such progress of worldwide research and developments. Next target is to raise such a worldwide/national level activity to the progress of local industry and economy. After the big earthquake and tsunami, we are expected to contribute more in the local economy, especially in next generation automotives, one of the most important and emerging industries in Tohoku region.

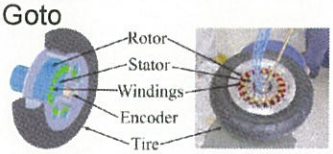
2. Organization and Targets

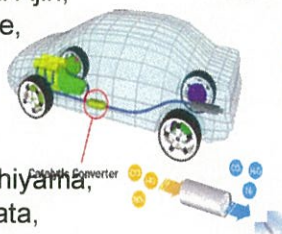
Automotive industry is composed of a variety of companies such as Tier1, Tier2, Tier3 and Tier4 companies. To promote worldwide/national level industrial collaborations and local level collaborations simultaneously and synergistically we have tried to construct organization which is comprised of local government, bank, academy, local bureaus of central governments, local economic organizations etc in addition to Tohoku University. Tohoku University collaborates with mainly Tier1/Tier2 companies, which make it difficult to directly collaborate with local companies. Local governments, banks, local bureaus of central governments, local capitals, local economic organizations on the other hand have strong network with local companies. For example, Miyagi Prefecture has strong supporting organization to almost all automotive companies not only Tier1, Tier2, but also small local companies. By constructing network with such local organizations, in the present national project, we have tried to construct strong organization to promote innovation in next generation automotives. Taking into account of a variety of possibilities of innovations in individual local companies, a variety of active researchers participate and collaborate in the project as shown in Fig. 1.

In the project, these laboratories perform the following programs: (1)collaborations through human resources development and (2)collaborations through the use of advanced apparatus/instruments. Many coordinators in the local governments, the local organizations and Tohoku University promote collaborations among different laboratories and companies for next generation automotives.

A.Catalysts and Functional Materials
Akira Miyamoto, Tsugio Sato,
Hiroshi Inomata, Atsushi Muramatsu,
Hirotsugu Takizawa, Masafumi Ajiri,
Mikio Konno, Keiichi Tomishige,
Ai Suzuki

B. Motor and Magnet
Fumihiko Hasegawa, Osamu Ichinokura,
Satoshi Sugimoto, Takashi Nakamura,
Hiroki Goto





C. Robot
Satoshi Tadokoro,
Kazuhiro Kosuge, Masaru Uchiyama,
Kazunori Ohno, Yasuhisa Hirata,
Eijiro Takeuchi

D. Wireless Charging
Hidetoshi Matsuki

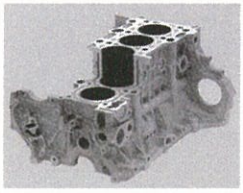
E. Battery *(Optic, Hydrogen)*
Junichi Kawamura,
Shigenao Maruyama,
Shinichi Orimo , Tomokazu Matsue,
Hitoshi Takamura, Kazuyuki Tohji,
Akira Miyamoto, Nozomu Hatakeyama

F.Semiconductor
Tadahiro Ohmi,
Shigetoshi Sugawa,
Akira Yoshikawa,
Toyohiko Konno

G. Interface and Triborogy
Tetsuo Shoji, Toshiyuki Takagi,
Koshi Adachi, Kazue Kurihara,
Akira Miyamoto, Ryuji Miura

H. Welding and Adjunction
Hiroyuki Kokawa, Akira Miyamoto, Nozomu Hatakeyama

J. Vision Analysis
Tatsuo Uchida, Takafumi Aoki,
Koichiro Deguchi, Masahiro Nishizawa



K. Medical Application and MEMS
Ryuta Kawashima,
Masafumi Goto,
Masayoshi Esashi,
Naoyuki Narushima,
Hidetoshi Matsuki
Tsunemoto Kuriyagawa

I. Casting, Forging and Nano-Fabrication
Tsunemoto Kuriyagawa, Fumio Fujita,
Koichi Anzai, Akihiko Chiba,
Hitoshi Soyama

L. Local Industry Policy
Masato Hisatake,
Shunsuke Managi

文部科学省 社団法人東北経済連合会 東北大学 宮城県 七十七銀行 ICR

Fig.1: Targets and researchers in the project of next generation automotives(cf. www.miyagicar.com)

Next Generation Automotives: Goal of the National Project in Japan

Akira Miyamoto

New Industry Creation Hatchery Center

Tohoku University, Sendai, Japan

Akira Miyamoto

TOHOKU UNIVERSITY, New Industry Creation Hatchery Center

1969-1989(20 years)(Tohoku University, Nagoya University, Kyoto University)

- Experimental works about heterogeneous catalyses

1987-2013(26 years) (Kyoto University, Tohoku University)

- Computational works about catalysts and materials design to establish novel methodologies in chemistry for industrial innovations.

2010-2013(4 years) (Tohoku University)

- Collaborations among Academy, Industry, and Government for Next Generation Automotives

Next Generation Automotives: Goal of National Project

1. Expected Mission of Tohoku University, as one of the Most Active Research Universities, after the Big Earthquake/Tsunami
2. Global/Local Importance of Automotive Industry
3. Organization to realize Simultaneous Global/Local innovations.
4. Research/Technological Potentials in Tohoku University for the Next Generation Automotives.
5. Activities of Local Government, Bank, Local Bureaus of Central Governments, Local Capitals, Local Economic Organizations, and Local Companies.
6. Programs and Coordinators
7. Concluding Remarks

Expected Mission of Tohoku University after the Big Earthquake/Tsunami

Rapid progress of globalization in industry and economy has led to the increased importance of a variety of advanced academic activities in industrial research and developments. As one of the most active research universities, Tohoku University has contributed significantly to such progress of worldwide research and developments. Next target is to raise such a worldwide/national level activity to the progress of local industry and economy. After the big earthquake and tsunami, we are expected to contribute more in the local economy, especially in next generation automotives, one of the most important and emerging industries in Tohoku region.

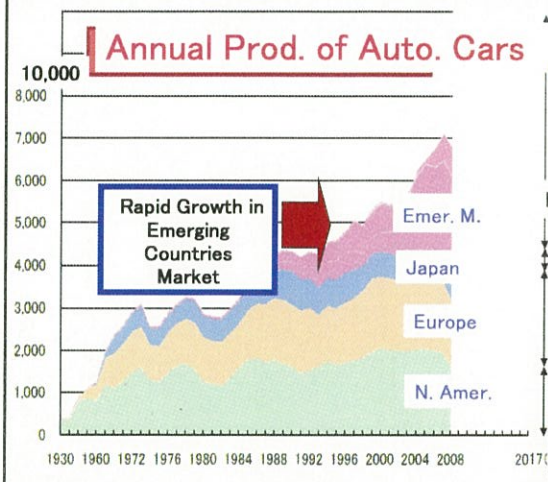
Targets and Researchers in the Project of Next Generation Automotives

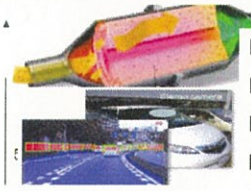
Next Generation Automotives: Goal of National Project

1. Expected Mission of Tohoku University, as one of the Most Active Research Universities, after the Big Earthquake/Tsunami
2. Global/Local Importance of Automotive Industry
3. Organization to realize Simultaneous Global/Local innovations.
4. Research/Technological Potentials in Tohoku University for the Next Generation Automotives.
5. Activities of Local Government, Bank, Local Bureaus of Central Governments, Local Capitals, Local Economic Organizations, and Local Companies.
6. Programs and Coordinators
7. Concluding Remarks

Glowing Global/Local Market of Automotive Industry

7





Environment
Energy, Safety
Medical, ITS
Network, Grid
Sustainable

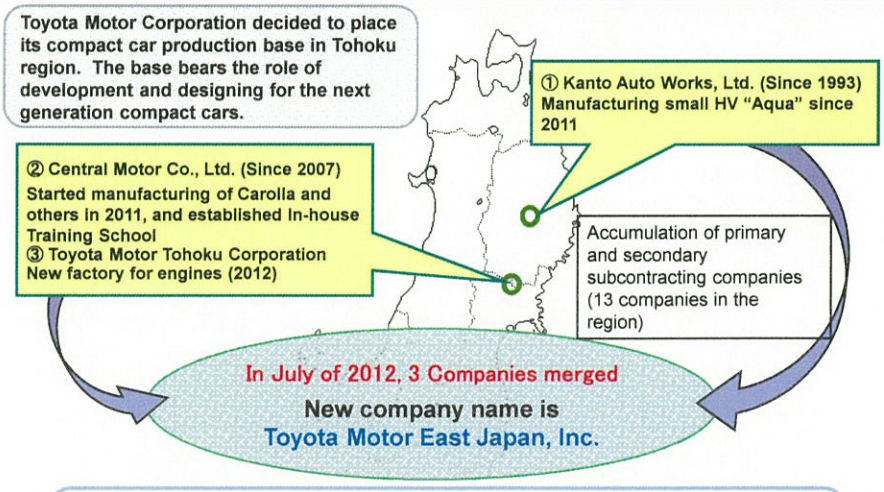
Hybrid-EV and EV

Next Generation Automotives, such as EV, HV, PHV Promote a variety of Technological Challenges

Increasing Accumulation of Automobile Industry in Tohoku Region

8

Toyota Motor Corporation decided to place its compact car production base in Tohoku region. The base bears the role of development and designing for the next generation compact cars.



Manufacturing system in Tohoku region to 500,000 cars annually

Manufacturing capability of finished cars in Tohoku region increased with start-up of Central Motor Co., Ltd. (in Jan., 2011)

Next Generation Automotives: Goal of National Project

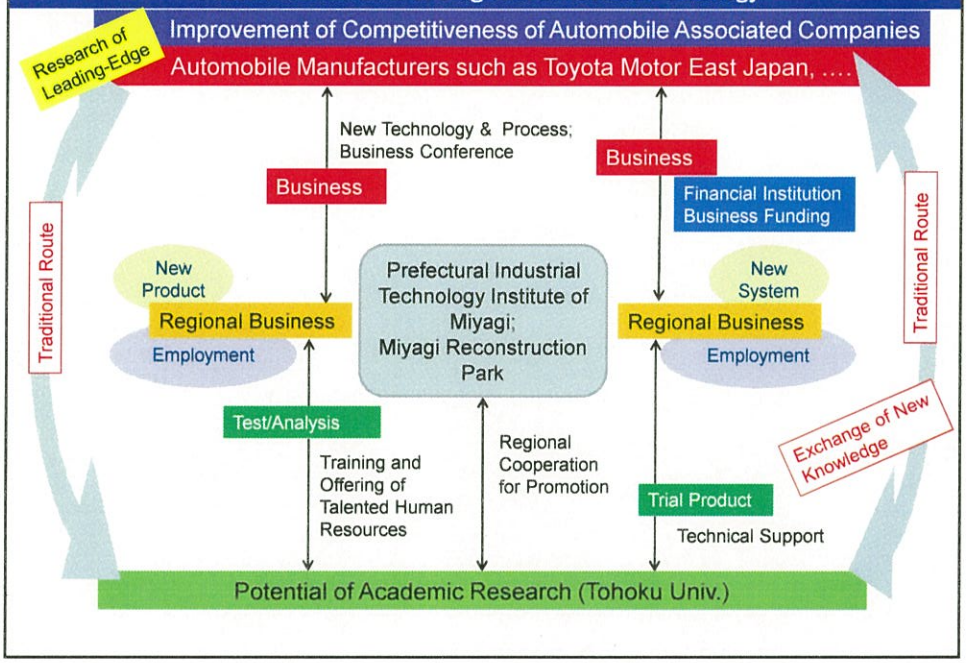
1. Expected Mission of Tohoku University, as one of the Most Active Research Universities, after the Big Earthquake/Tsunami
2. Global/Local Importance of Automotive Industry
3. Organization to realize Simultaneous Global/Local Innovations.
4. Research/Technological Potentials in Tohoku University for the Next Generation Automotives.
5. Activities of Local Government, Bank, Local Bureaus of Central Governments, Local Capitals, Local Economic Organizations, and Local Companies.
6. Programs and Coordinators
7. Concluding Remarks

Organization to realize Simultaneous Global/Local Innovations.

Automotive industry is composed of a variety of companies such as Tier1, Tier2, Tier3 and Tier4 companies. To promote worldwide/national level industrial collaborations and local level collaborations simultaneously and synergistically we have tried to construct organization which is comprised of local government, bank, academy, local bureaus of central governments, local economic organizations etc in addition to Tohoku University. Tohoku University collaborates with mainly Tier1/Tier2 companies, which make it difficult to directly collaborate with local companies.

Local government, bank, local bureaus of central governments, local capitals, local economic organizations on the other hand have strong network with local companies. For example, Miyagi Prefecture has strong supporting organization to almost all automotive companies not only Tier1, Tier2, but also small local companies. By constructing network with such local organizations, in the present national project, we have tried to construct strong organization to promote innovation in next generation automotives. Taking into account of a variety of possibilities of innovations in individual local companies, a variety of active researchers participate and collaborate in the project.

Industry-Academia-Government Innovation for Next Generation Automobile 11
– Overall Mechanism of Regional Innovation Strategy –



Industry-Academia-Government Innovation for Next Generation Automobile 12
– Overall Mechanism of Regional Innovation Strategy –

Next Generation Automobile Innovation Promotion Council

Round Table
Governor of Miyagi Pref.
Mayer of Sendai-city
President of Tohoku Univ. and Chairman of Tohoku Economic Federation

Project Operation Board
Worldwide Technology Trend Research Unit
Business/Commercialization Promotion Committee
Intellectual Property Committee
Regional/Wide Area Cooperation Promotion Committee
Research Promotion Committee
Progress Evaluation Committee
Publicity Committee
Intelligent Cosmos Research Institute

External Evaluation Committee

Advisory Board

(International Research Institute of Disaster Science at Tohoku University)

Organization for promoting Industry-Academia-Government Cooperation

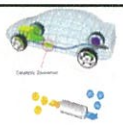
The 77 Bank; Sendai-city; Tohoku Bureau of Economy, Trade and Industry; Business Center of Tohoku Economic Federation;
Miyagi Organization For Industry Promotion (Miyagi Reconstruction Park); Miyagi Industrial Association; Automotive Industry Development Division of Miyagi Pref.; Sendai City Industrial Promotion Organization, etc.;
Tohoku Innovation Capital;
Universities & Colleges; and Tohoku Center of National Institute of Advanced Industrial Science and Technology, etc.

Cooperation with other regions in Tohoku District headed by Iwate Pref.

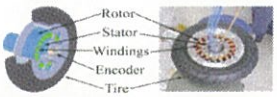
Next Generation Automotives: Goal of National Project

1. Expected Mission of Tohoku University, as one of the Most Active Research Universities, after the Big Earthquake/Tsunami
2. Global/Local Importance of Automotive Industry
3. Organization to realize Simultaneous Global/Local innovations.
4. Research/Technological Potentials in Tohoku University for the Next Generation Automotives.
5. Activities of Local Government, Bank, Local Bureaus of Central Governments, Local Capitals, Local Economic Organizations, and Local Companies.
6. Programs and Coordinators
7. Concluding Remarks

A.Catalysts and Functional Materials
Akira Miyamoto, Tsugio Sato, Hiroshi Inomata, Atsushi Muramatsu, Hirotsugu Takizawa, Masafumi Ajiri, Mikio Konno, Keiichi Tomishige, Ai Suzuki



B. Motor and Magnet
Fumihiko Hasegawa, Osamu Ichinokura, Satoshi Sugimoto, Takashi Nakamura, Hiroki Goto



C. Robot
Satoshi Tadokoro, Kazuhiro Kosuge, Masaru Uchiyama, Kazunori Ohno, Yasuhisa Hirata, Eijiro Takeuchi

E. Battery, Energy, Optics and Hydrogen
Junichi Kawamura, Shigenao Maruyama, Shinichi Orimo , Tomokazu Matsue, Hitoshi Takamura, Kazuyuki Tohji, Akira Miyamoto, Nozomu Hatakeyama

D. Wireless Charging
Hidetoshi Matsuki

F.Semiconductor
Tadahiro Ohmi, Shigetoshi Sugawa, Akira Yoshikawa, Toyohiko Konno

G. Interface and Triborogy
Tetsuo Shoji, Toshiyuki Takagi, Koshi Adachi, Kazue Kurihara, Akira Miyamoto, Ryuji Miura

H. Welding and Adjunction
Hiroyuki Kokawa, Akira Miyamoto, Nozomu Hatakeyama

J. Vision Analysis
Tatsuo Uchida, Takafumi Aoki, Koichiro Deguchi, Masahiro Nishizawa

I. Casting, Forging and Nano-Fabrication
Tsunemoto Kuriyagawa, Fumio Fujita, Koichi Anzai, Akihiko Chiba, Hitoshi Soyama

K. Medical Application and MEMS
Ryuta Kawashima, Masafumi Goto, Masayoshi Esashi, Naoyuki Narushima, Hidetoshi Matsuki, Tsunemoto Kuriyagawa

L. Local Industry Policy
Masato Hisatake, Shunsuke Managi

Targets and Researchers in the Project of Next Generation Automotives

Black heat shield paint utilizing nano/micro particles

Heat transfer control laboratory, Institute of Fluid Science,
Prof. Shigenao MARUYAMA

http://toyota.jp/voxy

Goal of this study

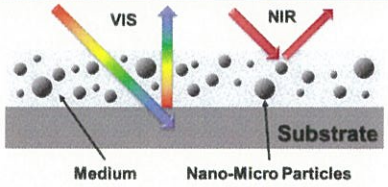
Development of spectral selective coating which reduces heating by sunlight but is black.

Background

Typical black paint

→ Good appearance but high absorption of sunlight

To reduce cooling load with keeping appearance
Cool black coating using micro/nano particle



Method

Design the coating by theoretical calculation and evaluate the performance of coating experimentally

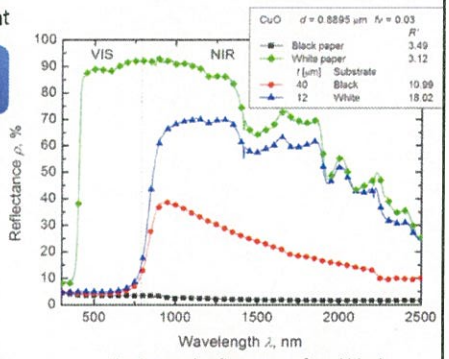


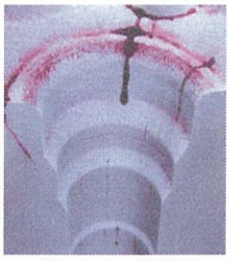
Fig. Spectral reflectance of cool black coating using CuO particle

Surface/Interface Integrity assessment
-Some Issues of Concerns in Casting and Forging in Automobile Industries

Prof. T. Shoji's Laboratory at NICHe

Modified from Nakayama's Presentation at Tohoku Univ.

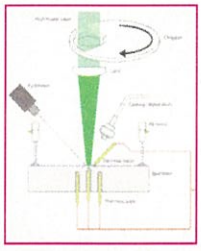
	Pouring/Work setting	Shaping	Release	Cooling	
Shaping by Casting (Solidification)		H		C	• •
Shaping by Forging (Plastic deformation Tribology, chemical wear)		H		C	• •



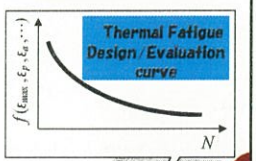
Cracked Die

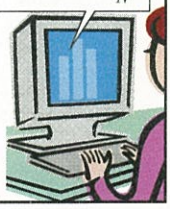
Thermal fatigue in Die (Heat Crack)

- ○***Initiation Mechanisms***
- ○***Propagation Characteristics***
- ○***Design Review and CAE***



Reproduction of Heat Crack

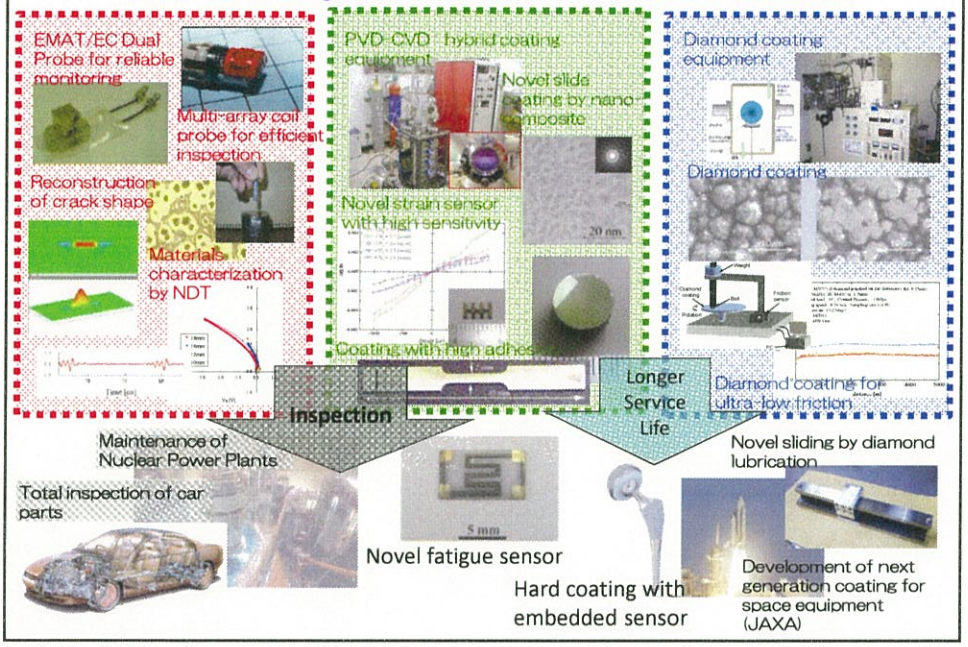




Heat Crack by Cyclic Heating⇔Cooling in Process

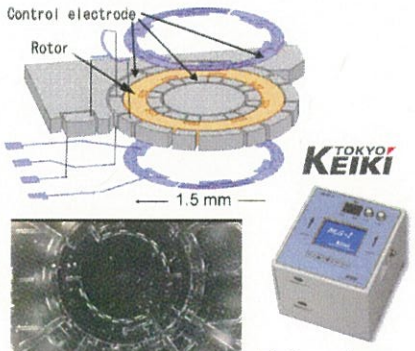
System and Energy Maintenance Research

Lab. of Prof. T. Takagi, T. Uchimoto and H. Miki, Institute of Fluid Science



MEMS Based Safety Systems for Automotives (Lab. of Prof. M.Esashi & S.Tanaka)

Open collaboration with industry, MEMS (Micro Electro Mechanical Systems)

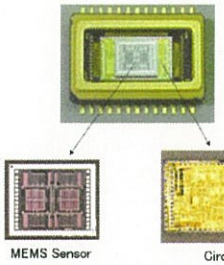


Motion logger for subway

Micro Electrostatically Suspended Accelerometer Gyro

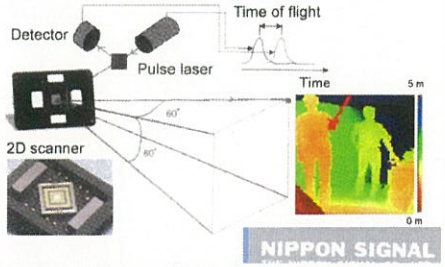
Rotor diameter1.5mm 74,000rpm

(Simultaneous measurement of 2 axes rotation and 3 axes acceleration)



More than 1 million Toyota cars use the **Yaw rate sensor**

TOYOTA

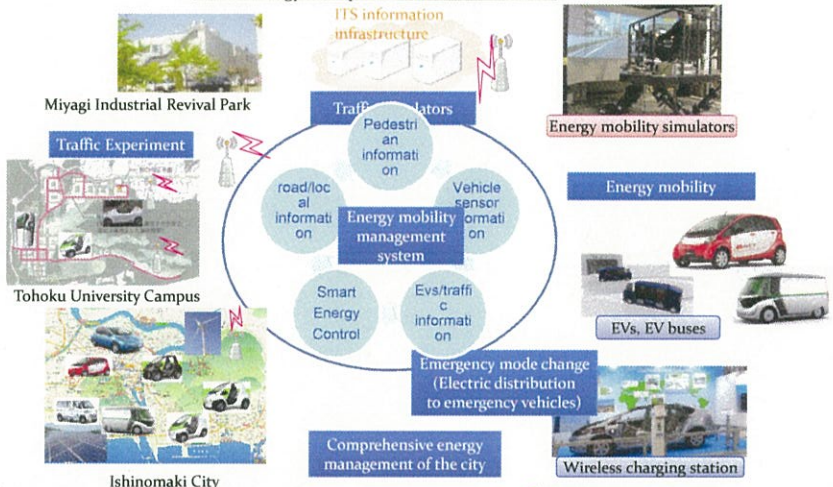


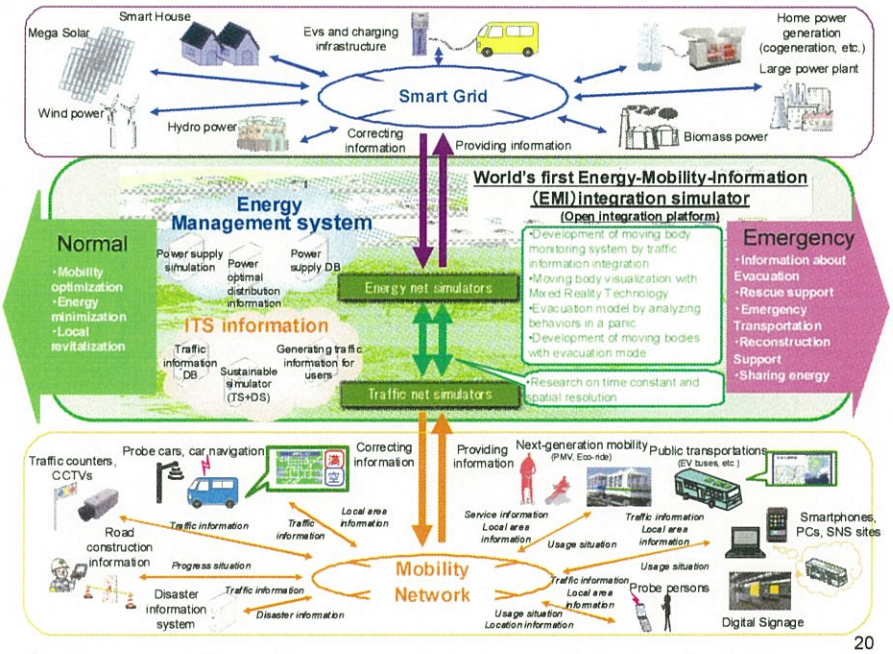
Ranging imager for safety systems

Next-Generation Advanced Mobility Systems

New Industry Creation Hatchery Center, Tohoku University
HASEGAWA Fumihiko, NISHIZAWA Masahiro OHNO Kazunori, YAMABE Shigeyuki, MATSUKI Hidetoshi

・Evaluation of IT integrated EV traffic/logistic system
・EV technology development research center Tohoku





RT (Robot Technology) Research and Education for Safe and Secure Societies. (Tadokoro Lab., GSIS)

1. Rescue Robots and Rescue Systems.

Rescue robots and related technologies for victim search and information gathering in rubble piles of large-scale disasters are developed. Our laboratory has been a center of the world rescue robotics research with leading nationwide projects of Japan Government. Quince was developed for high speed search in under-ground malls at 2010. Quince was used for the investigation in buildings of Fukushima Daiichi Nuclear Power Plant whose function was lost by the Great East Japan Earthquake in 2011, and showed the usefulness of the rescue robots over the world.

2. Actuation of Active Strings

Active or semi-active mobility of strings with small diameter is studied by applying new actuation principles. We have developed Active Scope Camera, which was used for forensic investigation of collapse of parking lot under construction in Jacksonville, USA in 2008 and 2010, and contributed to gather important evidences that could not be obtained by other robots and systems.

3. Intelligent personal mobility

Safety and convenience intelligent personal mobility are developed with autonomous mobile robot technology. The developed mobile robot technology realizes 1km autonomous navigation in public space at Tsukuba challenge 2009.

4. Haptics for Communication and Motion Support

Understanding human haptic functions, which are perceptual processes based on sense of touch, contributes to enhance our communication and physical motion capabilities. We have developed advanced haptic interfaces for real-time tactile communication on robot systems and intuitive interaction on mobile information devices. We also develop a haptic feedback technology to support human physical motion such as walking.

TOHOKU UNIVERSITY

System Robotics Laboratory

System robotics is a new field of robotics dealing with robot-related issues in real environments. Several prototypes of real world robots have been designed and developed based on robot technologies developed in our laboratory.

Passive Robot Concept

Passive Walking Assist System Based on User's Intention

Assistive Robotics

Human Intention Recognition

Robot Co-worker "PaDY"
(in-time Parts/tools Delivery to You robot)

Stable Power Augmentation

Human Robot Coordination

Human-Robot Interaction

New Grasping System

Design of New Robot Hands

iCART Concept

Intelligent Car Autonomous-Robot-Transporters

Mobile Dual Manipulators Coordination

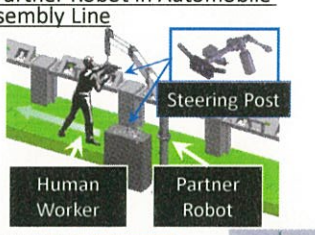
Parts Assembly by Dual Manipulators

Multiple Robots Coordination

Application of Robot Technologies in Automobile Industry

(Lab of Prof. Uchiyama)

A Partner Robot in Automobile Assembly Line



Test in assembly line

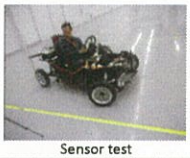
Developed partner robot

Robotized Assembly of a Wire Harness in a Car Production Line

Assembly experiment with developed Prototype robot system

Task planning simulator

Researches on Driving assistance of EV



Sensor test

Testbed

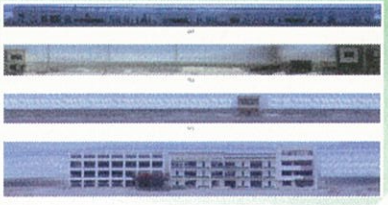
Computer Vision Technologies for Automotive-based City Modeling (Lab. of Prof. K. Deguchi and T. Okatani)

Optical camera based image recognition

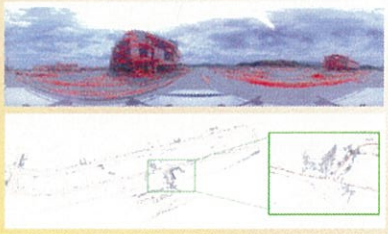
A) Omni-directional camera based image recording

– An application for disaster area

C) Generation of street panorama image from sequential images



B) 3D reconstruction of large space by Structure from Motion



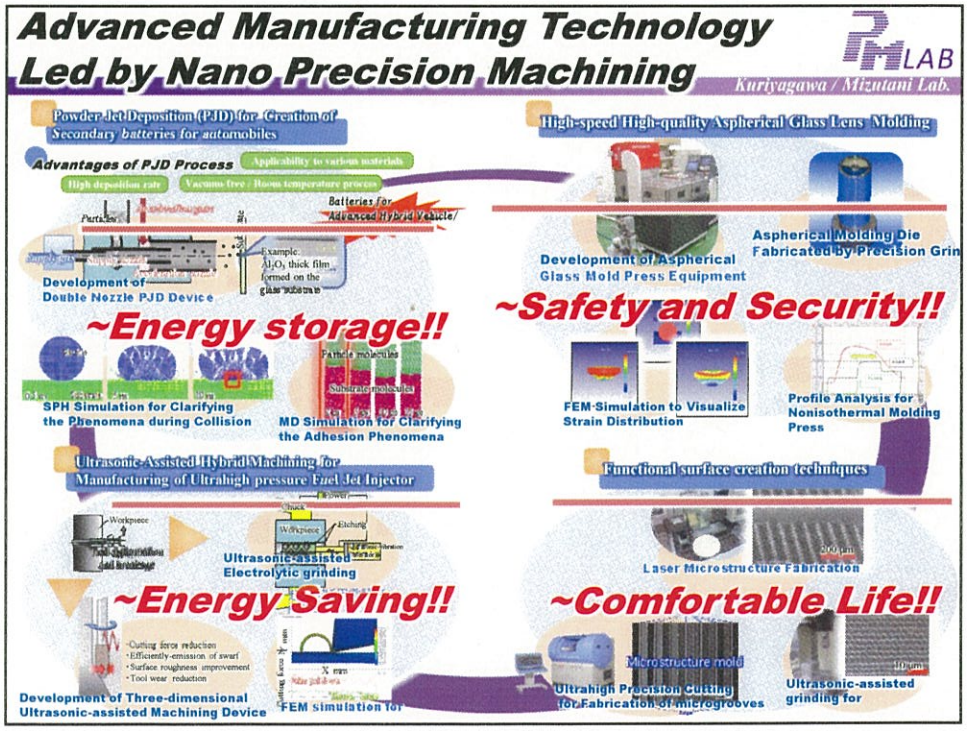
D) Temporal-change detection from sequential images

Creation of Advanced Mechanical Systems By Control of Nanointerface (Adachi & Takeno Laboratory)

Advanced Manufacturing Technology Led by Nano Precision Machining

PHLAB

Kuriyagawa / Miyzani Lab.



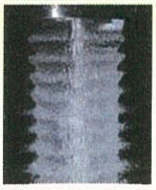
Surface Modification by Using Cavitation Impacts (Lab. of Prof. H. Soyama)

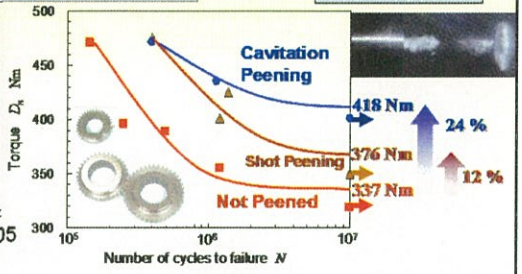
Impact at Cavitation Bubble Collapse

Erosion

Surface Modification

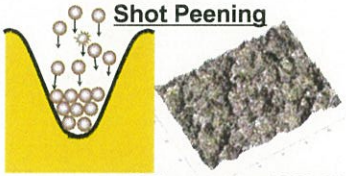
Cavitation Peening CP



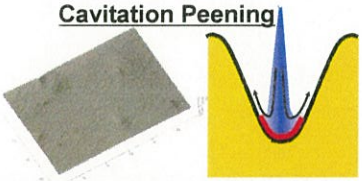


H.Soyama et al., *Surface & Coatings Technology*, Vol. 205 (2011), pp. 3167-3174.

Shot Peening



Cavitation Peening



H.Soyama and Y.Sekine, *International Journal of Sustainable Engineering*, Vol. 3, No. 1 (2010), pp. 25-32.

Production of Low-Cost and Highly Functionalized Titanium by Controlling the Light Elements

(Lab. of Prof. T. Narushima)

Characteristics of Titanium
- Low specific weight
- High chemical activity
- High corrosion resistance
- Allotropic transformation

Light Elements in Titanium
- High affinity
- High solubility
- Interstitial
- Low cost

Projects of Our Group

Low cost
- Construction of melting process with deoxidation

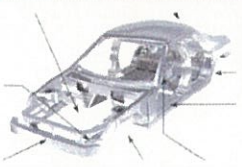
  Effective utilization of scrap and low grade titanium

Highly functionalization
- Microstructure control of titanium by micro alloying
- Addition of photocatalytic activity on titanium by thermal oxidation

Expansion of the use of titanium

Weight saving in vehicles

Building a Low-carbon society



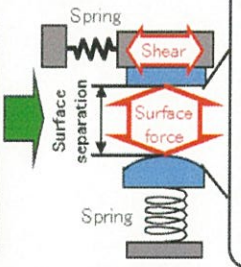
Surface Forces Measurement for Nano-Surface Chemistry and Tribology

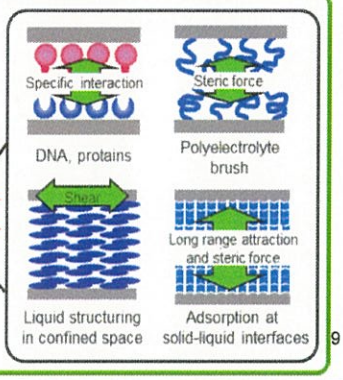
Kazue Kurihara (WPI Advanced Institute for Materials Research, Tohoku Univ.)

Our research aims at developing methods, including instrumentation, for characterizing surface (or interface) at the nano-meter level. Most of our research subjects are related to the surface forces measurement, which can directly monitor the interaction between two surfaces (attraction, repulsion and adhesion forces). We study phenomena occurring at the solid-liquid interface such as adsorption and structuring of liquids. Self-assembled molecular architectures and biological interactions are also studied. We have developed the resonance shear measurement which is a sensitive method for evaluating properties of confined liquid for nano-rheology and tribology. Twin-path surface forces apparatus we developed enabled us to study wide variety of samples such as metals and ceramics.

Development of nano-scale measurement

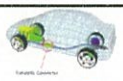
- Resonance Shear method
- Twinpath Surface Force Apparatus



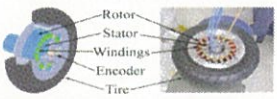


9

A.Catalysts and Functional Materials
Akira Miyamoto, Tsugio Sato, Hiroshi Inomata, Atsushi Muramatsu, Hirotsugu Takizawa, Masafumi Ajiri, Mikio Konno, Keiichi Tomishige, Ai Suzuki



B. Motor and Magnet
Fumihiko Hasegawa, Osamu Ichinokura, Satoshi Sugimoto, Takashi Nakamura, Hiroki Goto



C. Robot
Satoshi Tadokoro, Kazuhiro Kosuge, Masaru Uchiyama, Kazunori Ohno, Yasuhisa Hirata, Eijiro Takeuchi

E. Battery, Energy, Optics and Hydrogen
Junichi Kawamura, Shigenao Maruyama, Shinichi Orimo , Tomokazu Matsue, Hitoshi Takamura, Kazuyuki Tohji, Akira Miyamoto, Nozomu Hatakeyama

D. Wireless Charging
Hidetoshi Matsuki

G. Interface and Triborogy
Tetsuo Shoji, Toshiyuki Takagi, Koshi Adachi, Kazue Kurihara, Akira Miyamoto, Ryuji Miura

F.Semiconductor
Tadahiro Ohmi, Shigetoshi Sugawa, Akira Yoshikawa, Toyohiko Konno

J. Vision Analysis
Tatsuo Uchida, Takafumi Aoki, Koichiro Deguchi, **Masahiro Nishizawa**

H. Welding and Adjunction
Hiroyuki Kokawa, Akira Miyamoto, Nozomu Hatakeyama

I. Casting, Forging and Nano-Fabrication
Tsunemoto Kuriyagawa, **Fumio Fujita, Koichi Anzai, Akihiko Chiba,** Hitoshi Soyama

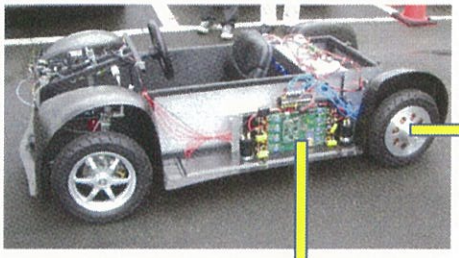
K. Medical Application and MEMS
Ryuta Kawashima, Masafumi Goto, Masayoshi Esashi, Naoyuki Narushima, Hidetoshi Matsuki, Tsunemoto Kuriyagawa

L. Local Industry Policy
Masato Hisatake, Shunsuke Managi

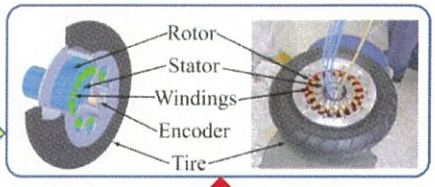
Targets and Researchers in the Project of Next Generation Automotives

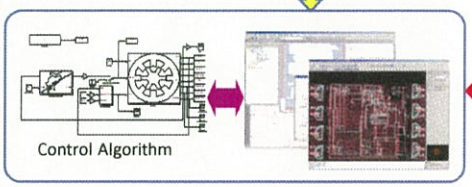
Motor Technology for Next Generation Automotive (Lab. of Prof. O. Ichinokura)

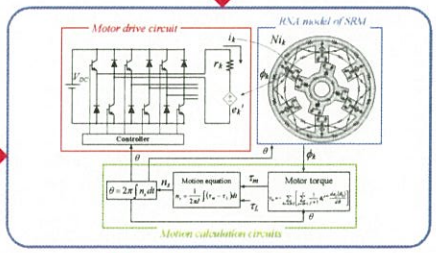
In-wheel Direct Drive EV



Optimum Motor Design







Development of High Performance Motor Controller

Fast & Accurate Dynamic Motor Analysis

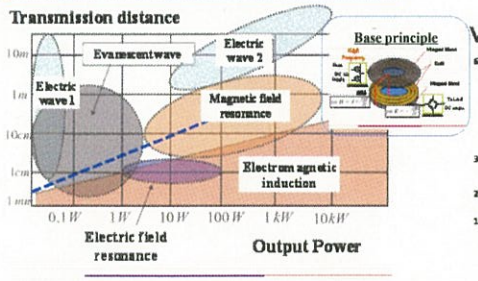
Contactless Power Transmission System

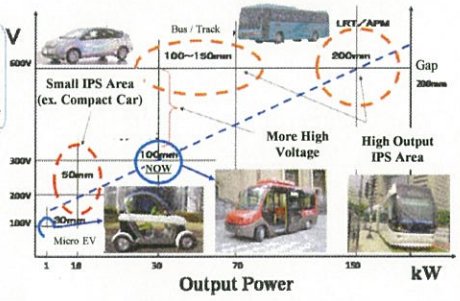
(Wireless Charging System)

Graduate school of biomedical engineering, Graduate school of engineering
Matsuki, Sato Laboratory

- Wireless Power Transmission Technology
- Wideband Transmitting power (mW～ 30kW)

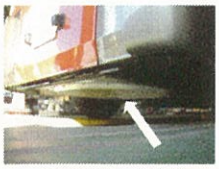
- Wireless Power transmission system for EV





LC-booster Technique

Battery less EV model car for Highway System



An actual 30kW Receiving Coil of EV Bus

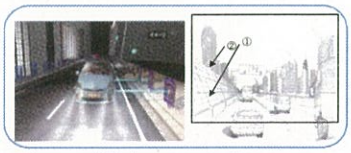
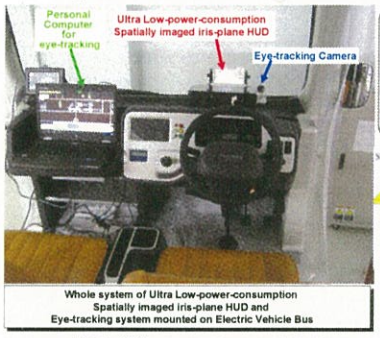


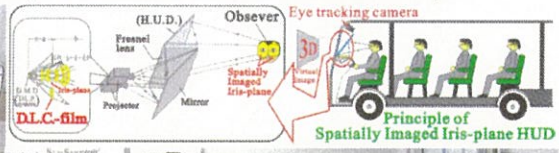
Image of Highway contactless power transmission system

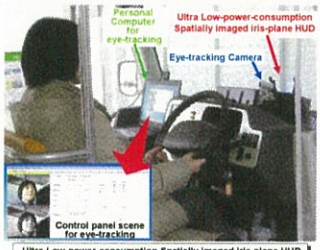
Hidetoshi MATSUKI, Fumihiro SATO
E-mail: fsato@ecei.tohoku.ac.jp

Ultra Low Power Consumption Display for Next Generation Automotives: Spatially Imaged Iris-plane Head Up Display (Lab. of Prof. T. Uchida, Y. Suzuki and T. Kawakami)

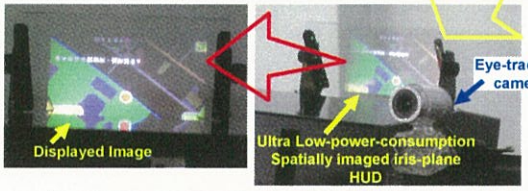


Whole system of Ultra Low-power-consumption Spatially imaged iris-plane HUD and Eye-tracking system mounted on Electric Vehicle Bus



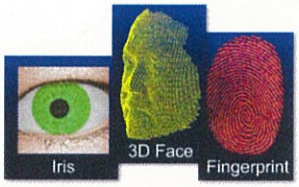


Ultra Low-power-consumption Spatially imaged iris-plane HUD and Eye-tracking system mounted on Electric Vehicle Bus



Ultra Low-power-consumption Spatially imaged iris-plane HUD mounted on Electric Vehicle Bus and Displayed image

Image Sensing Technology Breaking the Limit of Pixel Resolution (Lab. of Prof. T. Aoki)



Biometric authentication

Automotive vision systems

High-accuracy machine vision

3D human measurement

Photo

Medical image processing

Applications of a technique for high-accuracy registration of 1D, 2D and 3D signals using phase information of discrete Fourier transform, called Phase-Only Correlation

Dy-saving in Nd-Fe-B magnets: Lab. of Prof. S. Sugimoto

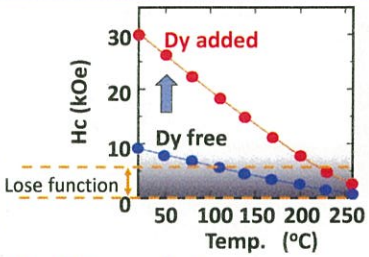
Hybrid-EV and EV

200 °C
High temp.

High coercivity(Hc)
↓
Dy addition on Nd-Fe-B

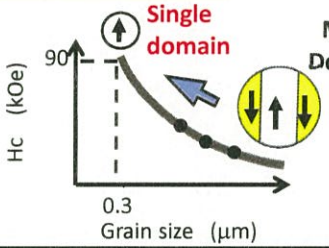
Price: Feb. 2012
Nd: ~145 $/kg
Dy: ~1800 $/kg

Demand for high *Hc* without Dy

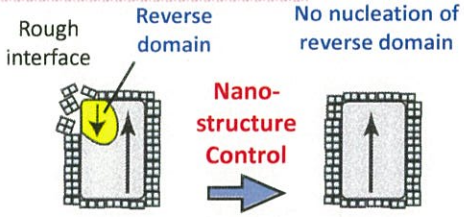


Approach for Enhancement of Coercivity

1. Grain Refinement



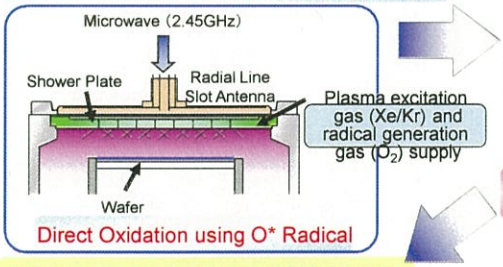
2. Grain Boundary Control



Possibility of Dy-free Nd-Fe-B Sintered Magnets with High Coercivity

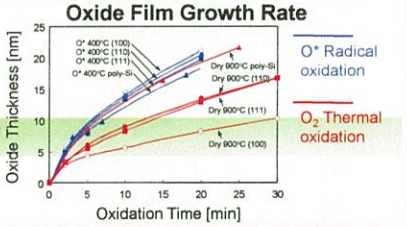
High-Reliability Power Semiconductor Device for Automotives (Lab. of Prof. S. Sugawa and T. Ohmi)

Radical Reaction Based Semiconductor Manufacturing Equipment



Direct Oxidation using O* Radical

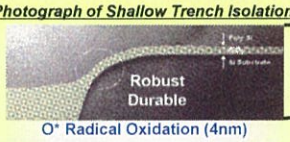
Oxide Film Growth Rate



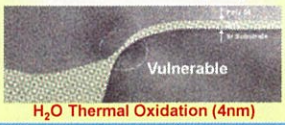
Growth Rate is Independent of Surface Orientation for O* Radical Oxide Films

Power Semiconductor Device

TEM Photograph of Shallow Trench Isolation (STI)

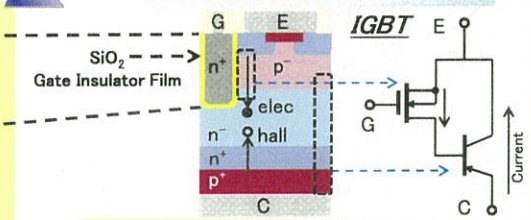


O* Radical Oxidation (4nm)



H_2O Thermal Oxidation (4nm)

Gate Oxidation of STI Edge without Thinning



Very uniform SiO_2 film can be formed on all the surface orientations by using O* Radical Oxidation

Reliable Power Semiconductor Device is realized by Radical Reaction Based Semiconductor Manufacturing Equipment

Yoshikawa lab. (NICHe, Tohoku Univ.)

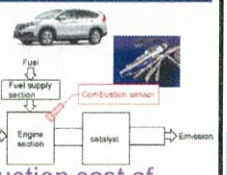
Akira Yoshikawa, Yuui Yokota, Shunsuke Kurosawa, Yasuhiro Shoji, Andrey Medvedev, Yoshisuke Futami

Development of combustion sensor with shaped piezoelectric crystal

(H22 Support Industry & Global support
[Ministry of Economy, Trade and Industry]
with TDK, Aoyama Seiko, Akira Seiko, KFN

Combustion sensor

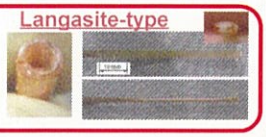
- Improvement of combustion rate
- Reduction of emission amount of NO_x



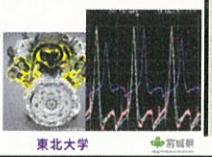
However, the production cost of piezoelectric crystal is too high.

Shaped crystals can reduce the production cost.

Langasite-type



Test model of combustion sensor

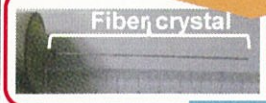


Development of fiber crystal of alloy with difficult workability

H23 Support Industry
[Ministry of Economy, Trade and Industry]
with TKK, Star Seiki ,TEP, Toei Kagaku Sangyo

Heat-resisting crucible (> 2000°C)

Growth of shaped crystal



Growth of Ir alloy fiber crystal can be achieved.

Applications

Spark plug

Guide wire

Stent

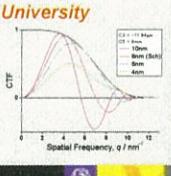
東北大学 七十七銀行 ICR

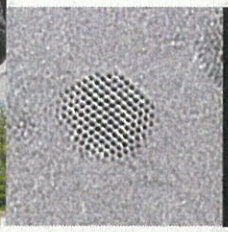
IMR

Advanced Analyses of Materials

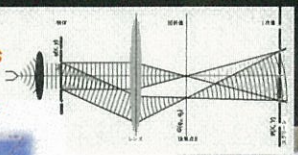
Institute for Materials Research, Tohoku University

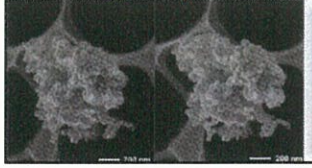
Professor, Toyohiko J. Konno
Associate Prof., Takanori Kiguchi
Assistant Prof., Kazuhisa Sato
pos-doc & graduate students





Phase transformation kinetics
Precipitation behaviors - mechanical properties
Oxide films - electrical properties
Metal/Alloy Nanoparticles- magnetic properties

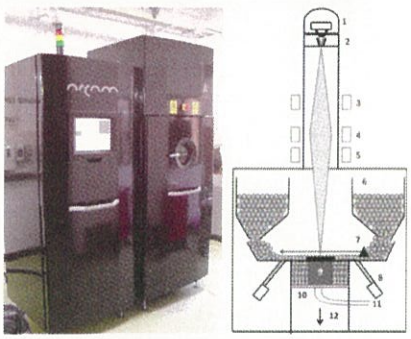




http://konno-lab.imr.tohoku.ac.jp/

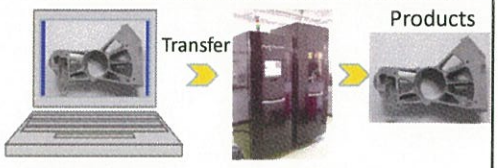
Digital Manufacturing (Metal 3D printer)
～3D CAD to Metal Products～
Lab. of Prof. Chiba

Electron Beam Melting



- Net shaping technique(Mold-less)
- Custom-made manufacturing
- Producing complex with solid dense metal and mesh metal

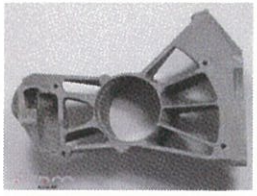
3D CAD to Metal Products



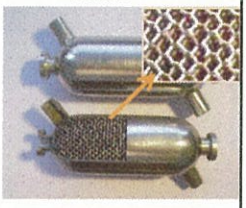
Reconstructed to 3DCAD
⇒2D slice data

Products

Gear Box



Filter



Metallurgy and Recycling System for Metal Resources Circulation
- Nakamura Lab.-

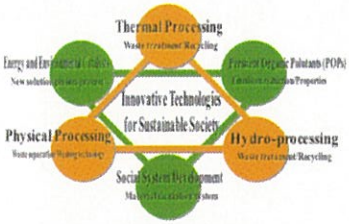
Institute of Multidisciplinary Research for Advanced Materials, Tohoku University

For Achievement of Sustainable Society

Our aim is to develop the process technologies and social systems for metal recycling, waste detoxification and energy recovery based on the nonferrous metal smelting industries.

- Thermal and hydro processing for metal recycling and wastes treatment (Chemical Thermodynamics)
- Social system for sustainable society (Reduce, Reuse and Recycling of wastes and materials)
- New solution plasma process to synthesize metal-carbon nanocomposits (Environmental Material)
- Innovative processes of physical separation and washing technology using microbubbles and ultrasound (Physical Treatment)

Concept and field of our research activities
(linkage of process technologies and social systems)



Our Research for Recycling Technology

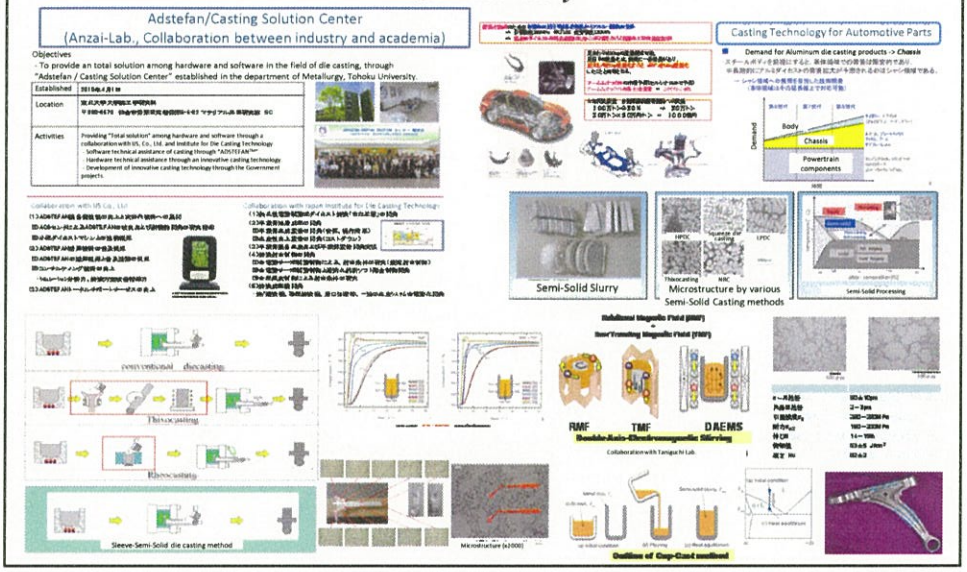
- Development of recycling processes of waste Nd-Fe-B magnet using pyro-metallurgical process
- Developments of recycling processes of non-ferrous base metals such as Cu,Zn and Pb.
- Developments of recycling processes of waste plastics containing Brominated flame retardants.
  - ・Basic behaviors of degradation of Brominated flame retardants
  - ・Measurements of vapor pressures of various metallic borimides
- Development of a novel recycling process for funnel glasses from CRT

Nd-Fe-B Magnet Recycling from Car motor

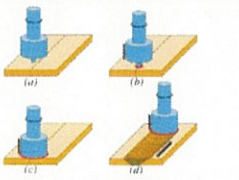
Dismantle of motor of HEV

Development of Innovative Semi-Solid Casting

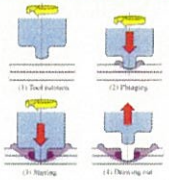
Department of Matallurgy, Graduate School of Engineering
Anzai Laboratory



New solid-state joining processes for automotive industry (Lab. of Prof. Hiroyuki Kokawa)

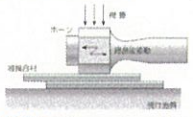


FSW (Friction stir welding)



FSSW (Friction stir spot welding)

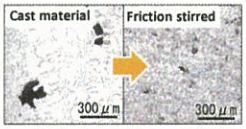
UAM (Ultrasonic additive manufacturing)



USW (Ultrasonic welding)

Mechanism of new solid-state joining processes
Dissimilar welding for multi-material car bodies (Al/Fe, Al/Mg etc.)
Enhancement of fatigue life and ductility of cast material parts
Welding of ultrahigh strength steels
Parts productions with complex shapes via UAM

Dissimilar FSSW of Al/Fe



Cast defect elimination and homogenization by friction stirring

FSW Tool development for welding of ultrahigh strength steels

Complex shaped parts manufactured by UAM

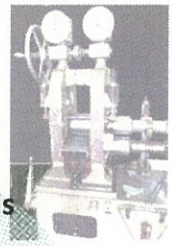
Forming Process Technology
Department of Metullurgy (Lab. of Prof. F. Fujita)

Create New Shape

Shaping Process
Control Process
Forming Limit

Create New Quality of Material

Strength
Formability (Texture)
Surface Texture



Plastic Forming

Rolling
Roll Forming
Pressing
Forging
Swaging
Stretching
Super Plasticity Forming

Numerical Analysis

FEM Analysis
Process Simulation
Theoretical Modeling

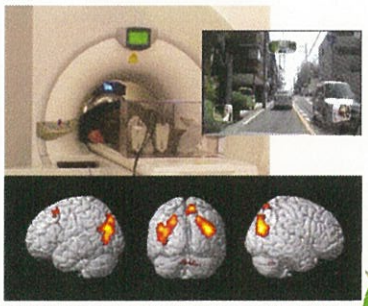
Physical Analysis

X-Ray Analysis
SEM, TEM Analysis

Steel, Al-alloy, Mg-alloy, Ti-alloy

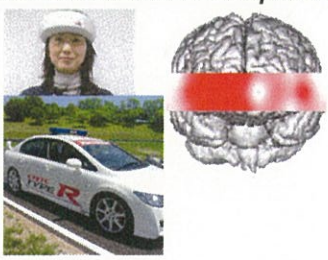
Applying Information of Human Brain Activity for R&D (Lab. of Prof. R. Kawashima)

Functional MRI



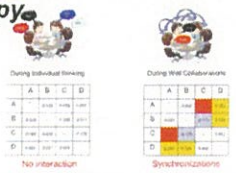
Brain Areas Involved in Hazard Detection

Wearable Near Infrared Spectroscopy

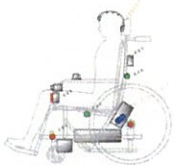


Brain Activity in the Prefrontal Cortex during Actual Driving

Ultra-small Near Infrared Spectroscopy



Synchronization of Brain Activity during Well Communication

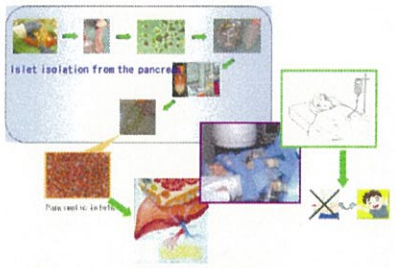


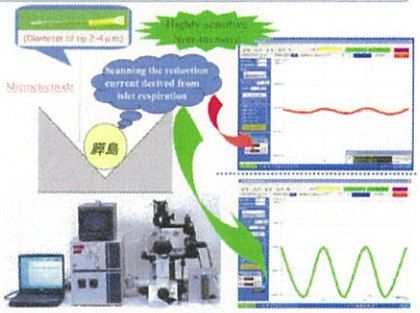
Machine Control by Internal Thought

Medical Application
(Lab. of Prof. Masafumi Goto)

http://www.tohoku-islets.com, http://www.cell-transplantation.med.tohoku.ac.jp/

Establishment of minimally invasive cell therapy for diabetes by introducing interdisciplinary approach

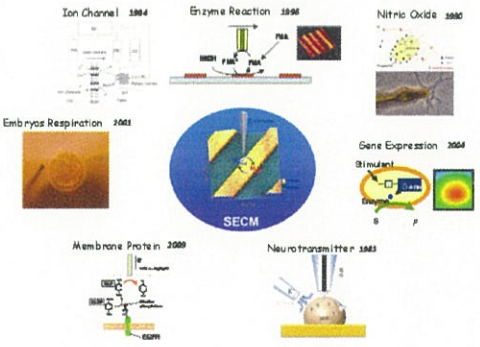




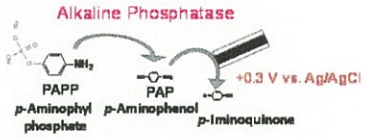
Micro/Nano Scale Electrochemical Measurement for Biological and Battery Materials

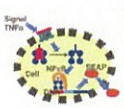
(Lab. of Prof. T. Matsue)

Scanning electrochemical microscope (SECM)

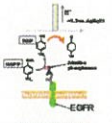


Living cell function measurement

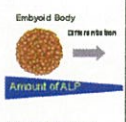




Anal. Chem., 2006, 78, 7625-7631.

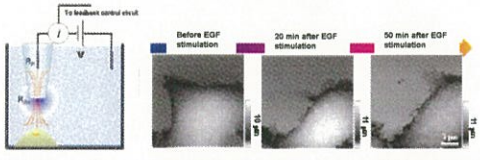


Anal. Chem., 2009, 81(7), 2785-2790.

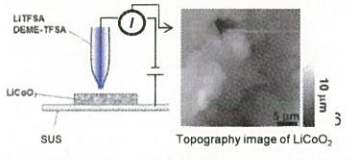


Angew. Chem. Int Ed., 2012, 51, 6648-6652.

Living cell Topography measurement

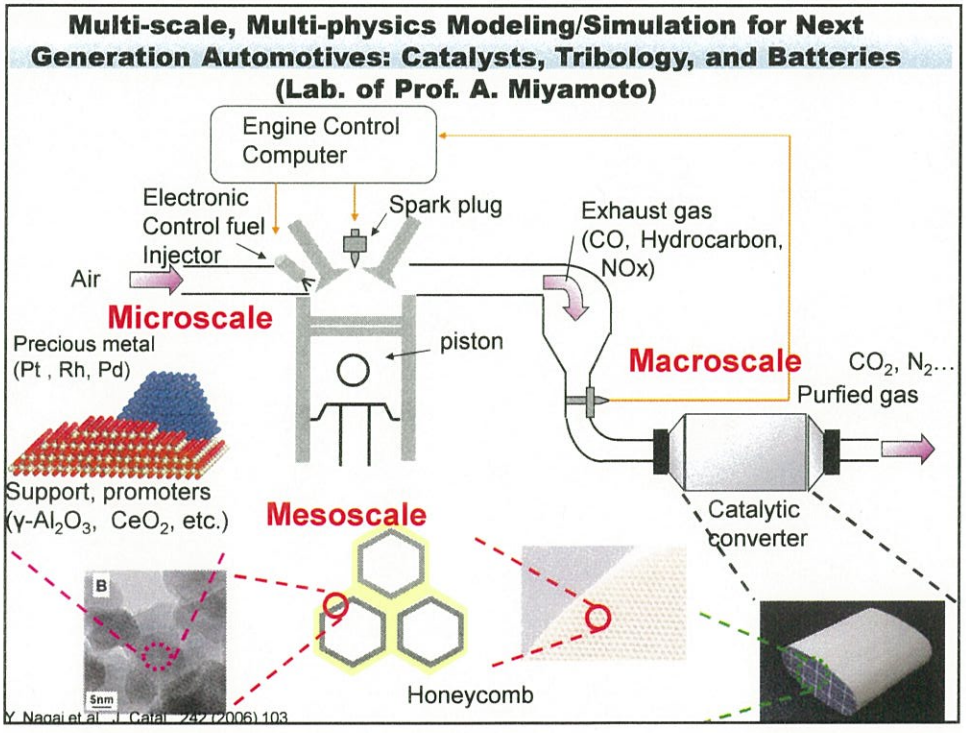


Battery material Topography measurement



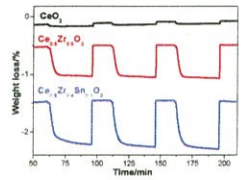
Topography image of $LiCoO_2$

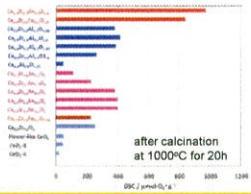

A.Catalysts and Functional Materials
Akira Miyamoto, Tsugio Sato, Hiroshi Inomata, Atsushi Muramatsu, Hirotsugu Takizawa, Masafumi Ajiri, Mikio Konno, Keiichi Tomishige, Ai Suzuki
B. Motor and Magnet
Fumihiko Hasegawa, Osamu Ichinokura, Satoshi Sugimoto, Takashi Nakamura, Hiroki Goto
Rotor
Stator
Windings
Encoder
Tire
C. Robot
Satoshi Tadokoro, Kazuhiro Kosuge, Masaru Uchiyama, Kazunori Ohno, Yasuhisa Hirata, Eijiro Takeuchi
E. Battery, Energy, Optics and Hydrogen
Junichi Kawamura, Shigenao Maruyama, Shinichi Orimo , Tomokazu Matsue, Hitoshi Takamura, Kazuyuki Tohji, Akira Miyamoto, Nozomu Hatakeyama
D. Wireless Charging
Hidetoshi Matsuki
F.Semiconductor
Tadahiro Ohmi, Shigetoshi Sugawa, Akira Yoshikawa, Toyohiko Konno
G. Interface and Triborogy
Tetsuo Shoji, Toshiyuki Takagi, Koshi Adachi, Kazue Kurihara, Akira Miyamoto, Ryuji Miura
H. Welding and Adjunction
Hiroyuki Kokawa, Akira Miyamoto, Nozomu Hatakeyama
J. Vision Analysis
Tatsuo Uchida, Takafumi Aoki, Koichiro Deguchi, Masahiro Nishizawa
I. Casting, Forging and Nano-Fabrication
Tsunemoto Kuriyagawa, Fumio Fujita, Koichi Anzai, Akihiko Chiba, Hitoshi Soyama
K. Medical Application and MEMS
Ryuta Kawashima, Masafumi Goto, Masayoshi Esashi, Naoyuki Narushima, Hidetoshi Matsuki, Tsunemoto Kuriyagawa
L. Local Industry Policy
Masato Hisatake, Shunsuke Managi
文部科学省
社団法人東北経済連合会
東北大学
宮城県
七十七銀行
ICR

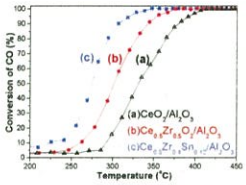

Multi-scale, Multi-physics Modeling/Simulation for Next Generation Automotives: Catalysts, Tribology, and Batteries
(Lab. of Prof. A. Miyamoto)
Engine Control Computer
Electronic Control fuel Injector
Spark plug
Exhaust gas (CO, Hydrocarbon, NOx)
Air
Microscale
Precious metal (Pt , Rh, Pd)
piston
Macroscale
CO_2, N_2...
Purfied gas
Support, promoters (γ-Al_2O_3, CeO_2, etc.)
Mesoscale
Catalytic converter
B
5nm
Honeycomb
Y. Nagai et al., J. Catal. 242 (2006) 103

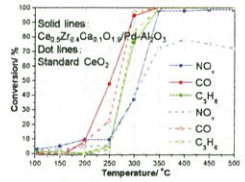
Solvothermal Synthesis of Ceria Based Metal Oxides for Automotive's Catalysts (T. Sato Laboratory, IMRAM, Tohoku University)

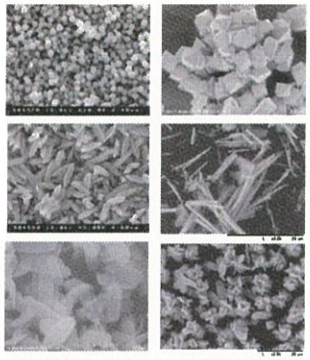
Composition Design — **Improvement of OSC & Three way Catalytic Activity** — **Morphological Control**











Improvement of OSC as well as the thermal stability was successfully realized by designing the composition of ceria based catalysts.

Ion doping and high specific surface area led to the improvement of catalytic activity of ceria based oxides.

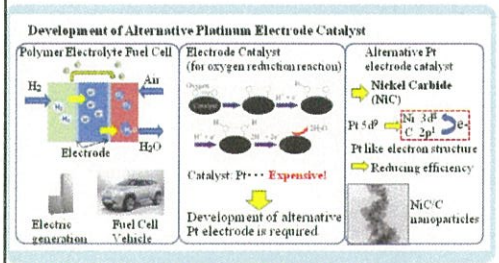
Morphology of the products could be controlled by an environmental friendly solvothermal process.

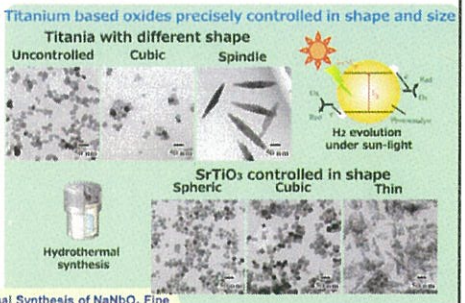
49

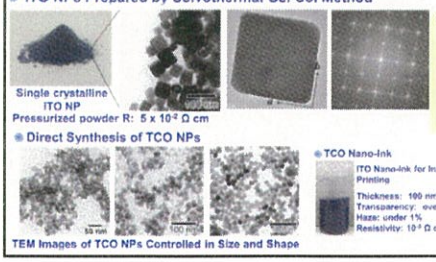
The OSC and catalytic activity could be improved by precisely controlling the chemical composition and morphology.

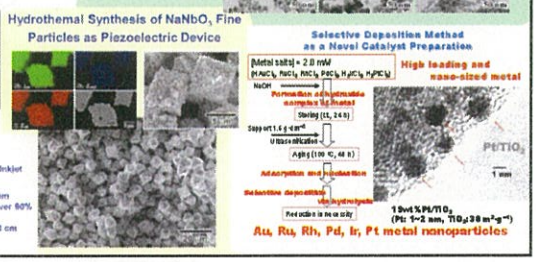
Synthesis of Hybrid Nano-Particles and Application to Functional Materials

Institute of Multidisciplinary Research for Advanced Materials, Tohoku Univ.
Muramatsu Laboratory

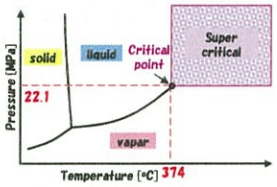


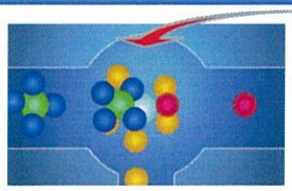


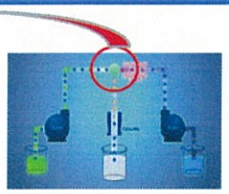




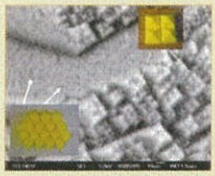
New catalyst for automobile using organic-inorganic Hybrid nano particles (Lab. of Prof. T. Adschiri)



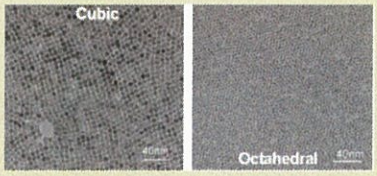




Make a organic-Inorganic hybrid nano particles in supercritical water



3D assembly



Control of exposed surface

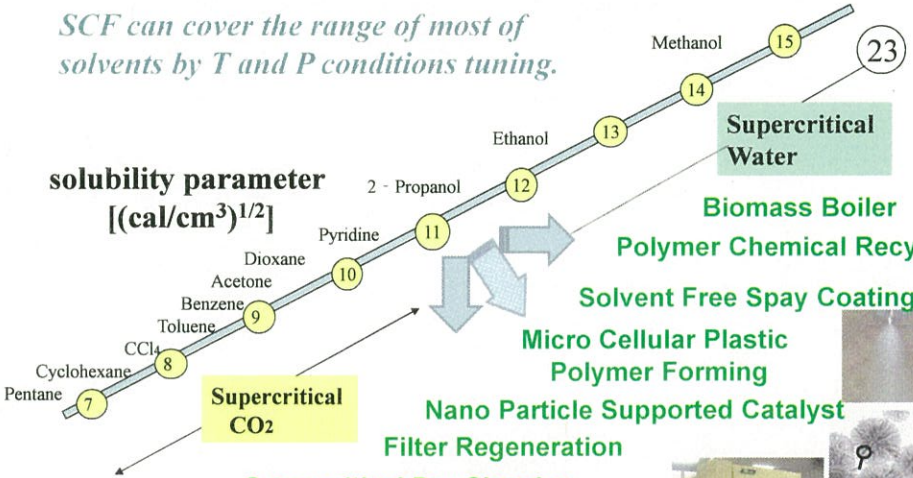
Dispersion in organic solution

These nano particles are used for automobile catalyst

51

Research Center of Supercritical Fluid Technology - Inomata Lab. Tohoku University -

SCF can cover the range of most of solvents by T and P conditions tuning.



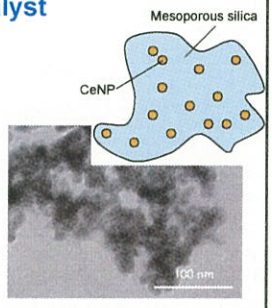
52

Design of Nanocatalyst Coated with Mesoporous Materials (Lab. of Prof. Mikio Konno)

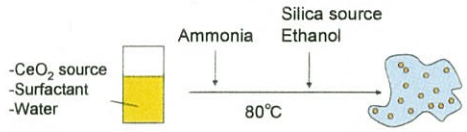
Objective

-Mesoporous silica coating of single-nanosized catalyst

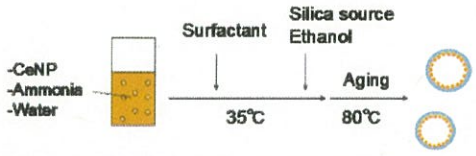
-Simple, environmentally-friendly method

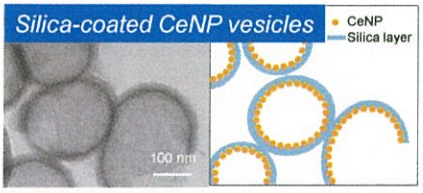


1. One-pot synthesis (CeO_2 nanoparticle (CeNP) : 6 nm)



2. Morphology control of nanoparticle assembly (CeNP: 4 nm)

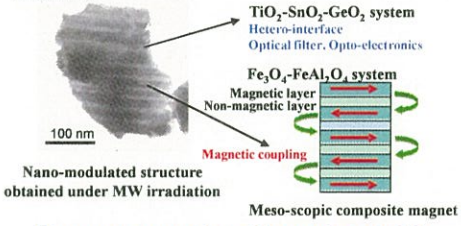




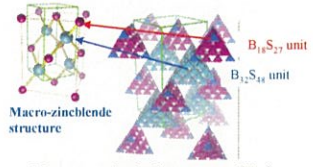
Synthetic Chemistry of Advanced Materials (Takizawa Lab.)
Department of Applied Chemistry

Hirotsugu Takizawa, Professor
Yamato Hayashi, Associate Professor
Jun Fukushima, Assistant Professor

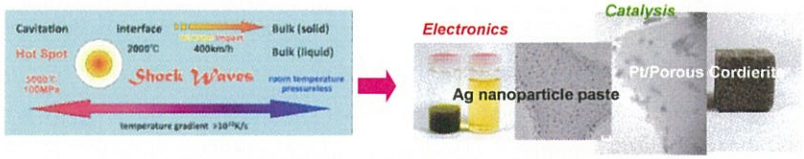
Structure and bonding in solid state materials are very relevant to modern technology. Takizawa Lab. deals with synthesis and characterization of advanced inorganic materials based on *Solid State Chemistry*.



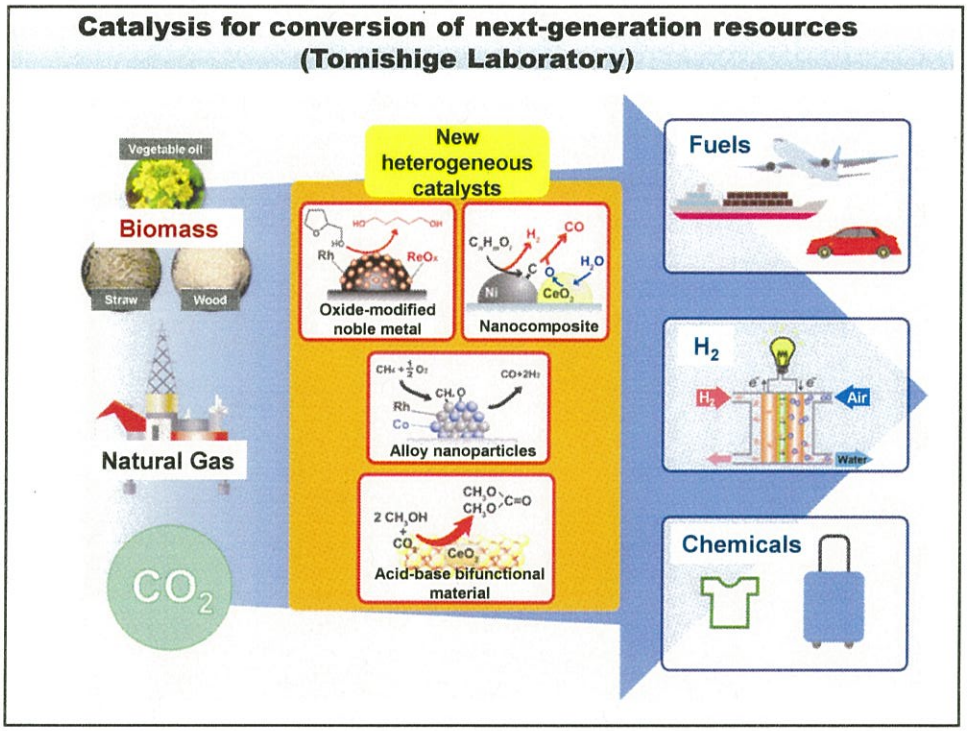
Microwave processing of inorganic materials

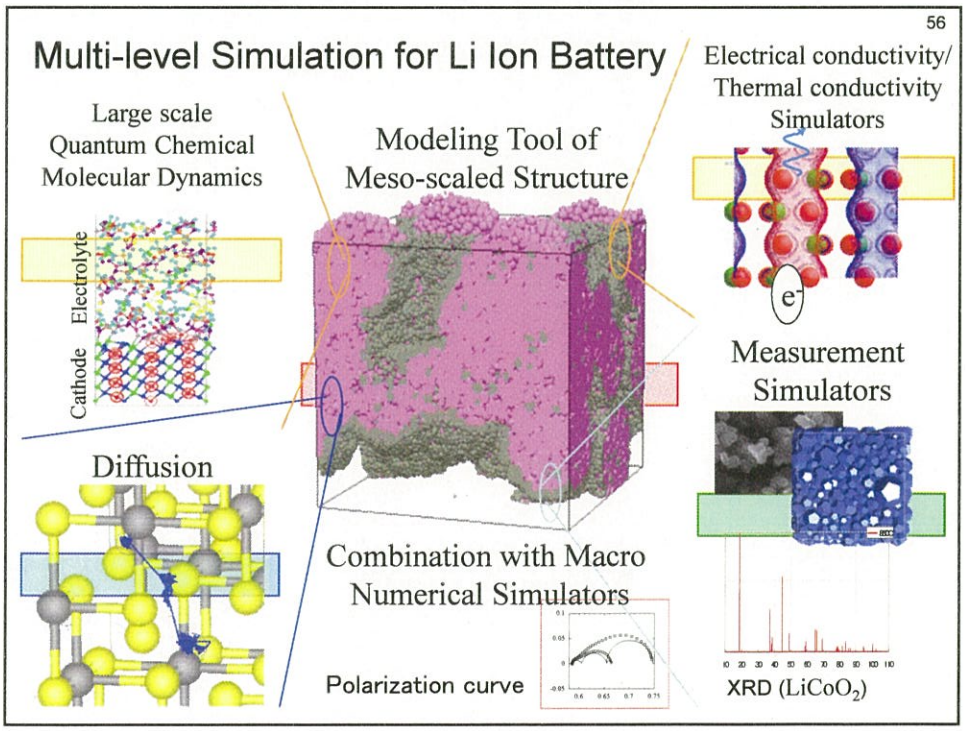


High-pressure synthesis and crystal chemistry of inorganic materials

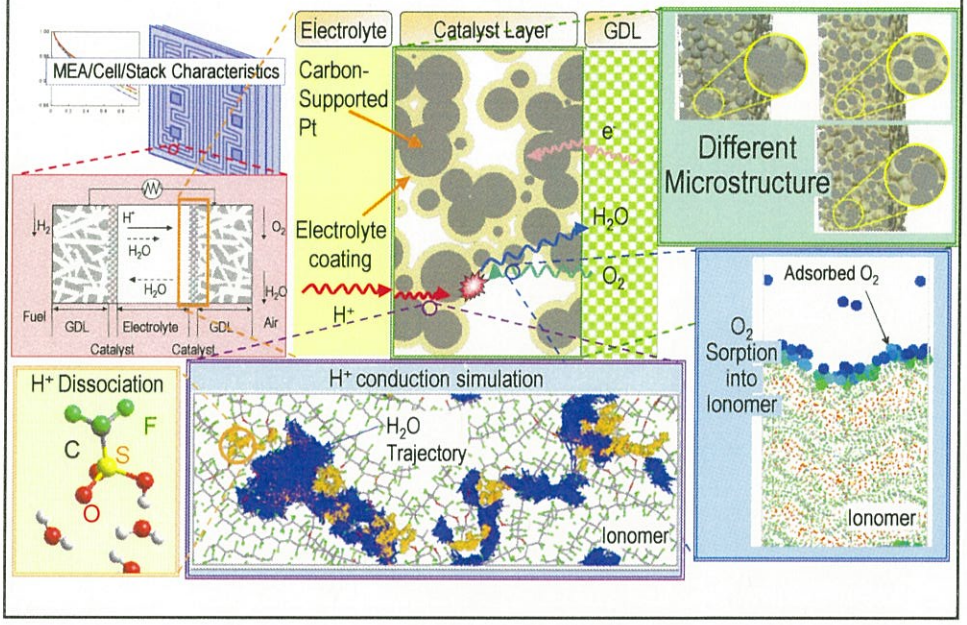


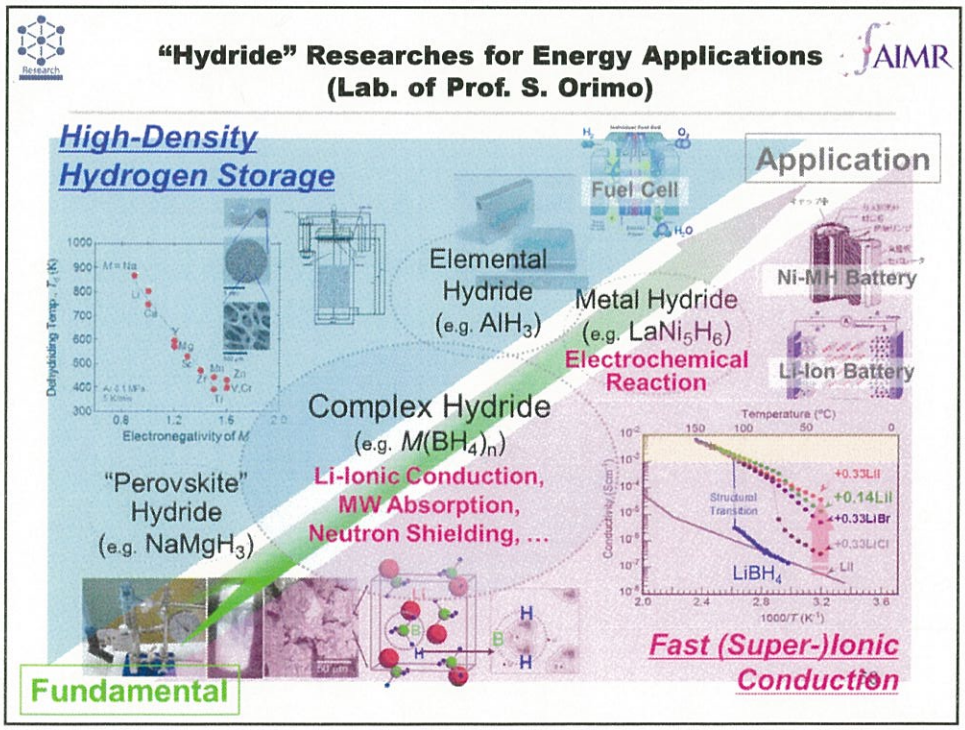
Sonochemical processing of inorganic materials


Catalysis for conversion of next-generation resources
(Tomishige Laboratory)
Vegetable oil
Biomass
Straw
Wood
Natural Gas
CO_2
New heterogeneous catalysts
Oxide-modified noble metal
Nanocomposite
Alloy nanoparticles
Acid-base bifunctional material
Fuels
H_2
Air
Water
Chemicals


56
Multi-level Simulation for Li Ion Battery
Large scale
Quantum Chemical
Molecular Dynamics
Electrolyte
Cathode
Diffusion
Modeling Tool of
Meso-scaled Structure
Combination with Macro
Numerical Simulators
Polarization curve
Electrical conductivity/
Thermal conductivity
Simulators
e-
Measurement
Simulators
XRD ($LiCoO_2$)

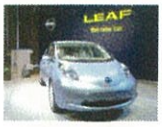
Application to Polymer Electrolyte Fuel Cell





All-Solid-State Lithium Battery by using $LiBH_4$ (Lab. of Prof. H. Takamura)

Large scale application

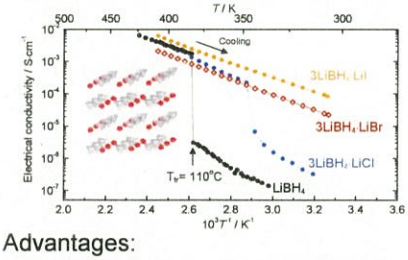


6.7Wh, 43g　　24kWh, 294kg　　10.8kWh, 340kg

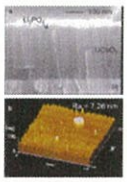
Issues to be solved

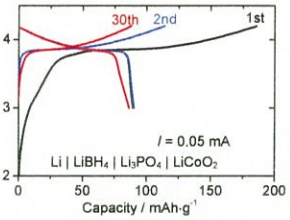
High capacity
Durability
Safety

$LiBH_4$ as a new solid electrolyte for LIB



All-solid-state LIB using $LiBH_4$





Advantages:

1) Large electrochemical window (> 5V)
2) Chemical compatibility with Li metal
3) Low grain boundary resistance

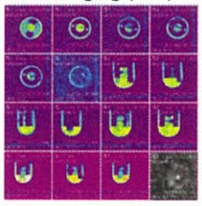
Breakthrough: Nanoscale layer between $LiBH_4$ and $LiCoO_2$

J. Power Sources (2013)

Developments of In Situ Measurement Techniques and Solid-State Lithium-Ion Batteries (Prof. J. Kawamura)

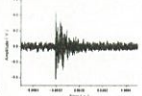
In situ measurement of Li-ion battery

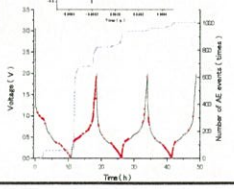
1. Magnetic resonance imaging (MRI)



↑NMR equipment and
→^{7}Li MRI image of a model Li-ion battery

2. Acoustic emission (AE)



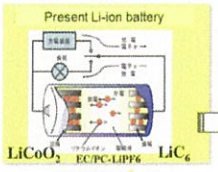


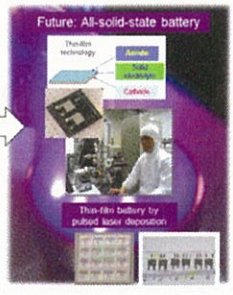
† AE experiment setup

↗AE waveform from model Li-ion cell

→Charge-discharge curves and AE events for 3 cycle

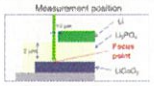
Solid-state Li-ion battery



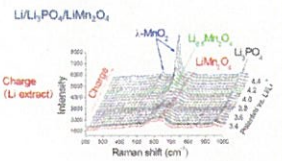


Fire accident of Li-ion battery (organic electrolyte)

3. Micro Raman spectroscopy (RS)



In situ micro Raman spectroscopy of a thin-film $LiMn_2O_4$ cathode in solid-state battery

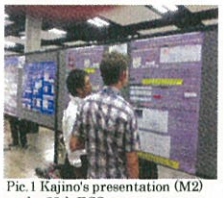


Environmentally Benign Systems
Designing of Nano-Ecomaterials

Professor
Kazuyuki Tohji
Graduate School of Environmental Studies
TOHOKU UNIVERSITY
6-6-20 Aoba Aramaki Aoba-ku, Sendai 980-8579,Japan

Development of functional nano-ecomaterials for energy and environment in the environmentally benign systems

The research of Tohji Laboratory focused on how to develop the well defined nano materials and how to utilize these materials to our life. Especially, we develop the synthesis and utilizing methods for useful nano material which utilize the surface properties, such as alloy and/or oxide-sulfide hybrid catalysts and electric Integration materials, and for energy materials to solve the global environment problems, such as thermoelectric alloy nanoparticles and high-power electric double-layer capacitor materials using carbon nanotubes etc. Moreover, the application of novel photocatalysts, called as stratified photocatalysts, to effective hydrogen generation system and environmental catalysts is also researched.



Pic.1 Kajino's presentation (M2) at the 22th ECS

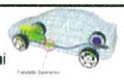
Pic.2 Mabuchi's presentation (M1) at the 22th ECS

Pic.3 Sakakibara's presentation (M1) at the MMIJ conference

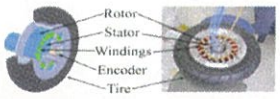
Pic.4 Suitoh (M1) introducing environmentally friendly energy at a summer festival

Pic.5 Kobayashi (M1) visiting a school to give a

A.Catalysts and Functional Materials
Akira Miyamoto, Tsugio Sato, Hiroshi Inomata, Atsushi Muramatsu, Hirotsugu Takizawa, Masafumi Ajiri, Mikio Konno, Keiichi Tomishige, Ai Suzuki



B. Motor and Magnet
Fumihiko Hasegawa, Osamu Ichinokura, Satoshi Sugimoto, Takashi Nakamura, Hiroki Goto



C. Robot
Satoshi Tadokoro, Kazuhiro Kosuge, Masaru Uchiyama, Kazunori Ohno, Yasuhisa Hirata, Eijiro Takeuchi

E. Battery, Energy, Optics and Hydrogen, **Junichi Kawamura,** Shigenao Maruyama, **Shinichi Orimo , Tomokazu Matsue, Hitoshi Takamura, Kazuyuki Tohji, Akira Miyamoto, Nozomu Hatakeyama**

D. Wireless Charging
Hidetoshi Matsuki

F.Semiconductor
Tadahiro Ohmi, Shigetoshi Sugawa, Akira Yoshikawa, Toyohiko Konno

G. Interface and Triborogy
Tetsuo Shoji, Toshiyuki Takagi, Koshi Adachi, Kazue Kurihara, Akira Miyamoto, Ryuji Miura

J. Vision Analysis
Tatsuo Uchida, Takafumi Aoki, Koichiro Deguchi, Masahiro Nishizawa

H. Welding and Adjunction
Hiroyuki Kokawa, Akira Miyamoto, Nozomu Hatakeyama

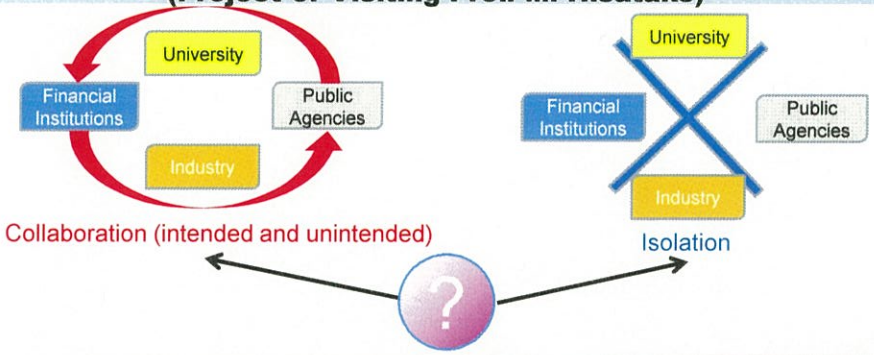
I. Casting, Forging and Nano-Fabrication
Tsunemoto Kuriyagawa, Fumio Fujita, Koichi Anzai, Akihiko Chiba, Hitoshi Soyama

K. Medical Application and MEMS
Ryuta Kawashima, Masafumi Goto, Masayoshi Esashi, Naoyuki Narushima, Hidetoshi Matsuki, Tsunemoto Kuriyagawa

L. Local Industry Policy
Masato Hisatake, Shunsuke Managi

文部科学省　社団法人東北経済連合会　東北大学　宮城県　七十七銀行　ICR

Development of Sustainable Regional Innovation Systems (Project of Visiting Prof. M. Hisatake)



Three objectives

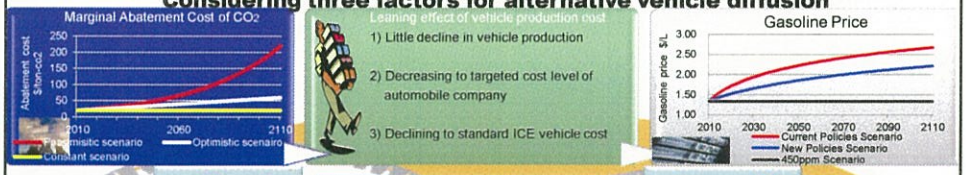
1. Identify cause and results of regional innovation systems
2. Try to create original and specifically elaborated development plans
3. Implementation and continuous PDCA

Feature = Interdisciplinary

Econometrics, Law and Economics, Game Theory, Contract theory, Technology Management Science, Business Administration Studies, Political Science, etc.

Potential of Alternative Fuel Vehicles: Analysis of Disaggregated Cost Benefit (Lab. of Prof. S. Managi)

Considering three factors for alternative vehicle diffusion



Cost | **Cost-Benefit Analysis** | **Benefit**

1. Alternative vehicle cost

Differences between the purchase and running cost of an alternative vehicle and ICEs vehicles

2. Infrastructure for Alternative vehicle

Construction and operating cost for alternative vehicle diffusion

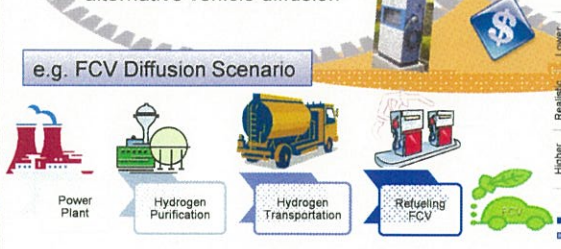
1. Emission reduction effects

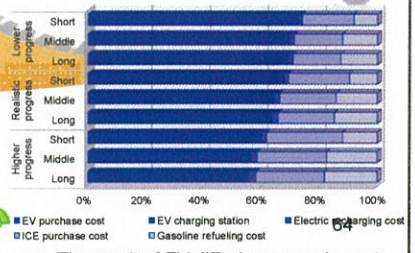
The amount of CO_2 and NOx emission reduction

2. Resource-saving effects

The amount of gasoline use reduction

e.g. FCV Diffusion Scenario



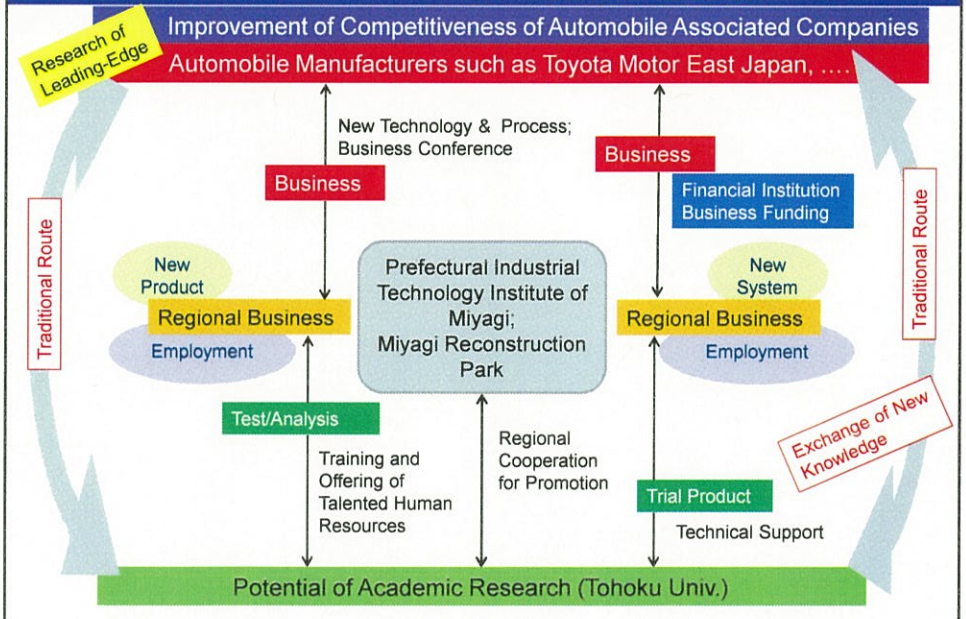


e.g. The result of EV diffusion scenario cost

Next Generation Automotives: Goal of National Project

1. Expected Mission of Tohoku University, as one of the Most Active Research Universities, after the Big Earthquake/Tsunami
2. Global/Local Importance of Automotive Industry
3. Organization to realize Simultaneous Global/Local innovations.
4. Research/Technological Potentials in Tohoku University for the Next Generation Automotives.
5. Activities of Local Government, Bank, Local Bureaus of Central Governments, Local Capitals, Local Economic Organizations, and Local Companies.
6. Programs and Coordinators
7. Concluding Remarks

Industry–Academia–Government Innovation for Next Generation Automobile – Overall Mechanism of Regional Innovation Strategy –



ITIM Industrial Technology Institute,Miyagi Prefectural Government

< Industry-Academia-Government Collaboration in R&D >

Universites & National Labs.

Local enterprises

ITIM

EMC, measurement facilities for car electronics

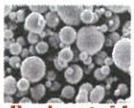
ITIM

Industry-Academia-Government Collaboration in R & D

Local enterprises

ITIM

Universites & National Labs.


Powder material

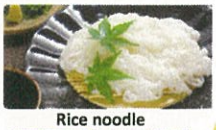

Filter

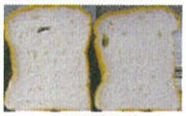

Ceramic plate


Cutting blade

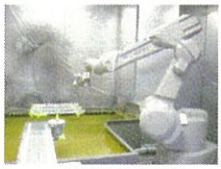

Toothed wheel


Machining tool


Rice noodle

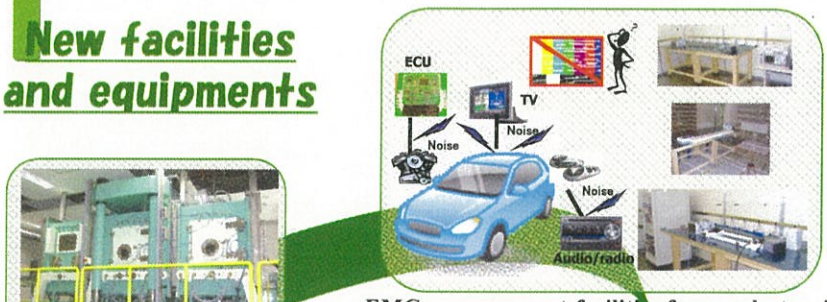

Rice Bread


"Sasa-kama" fish cake


CO_2 coating

ITIM

New facilities and equipments



EMC, measurement facilities for car electronics

2009

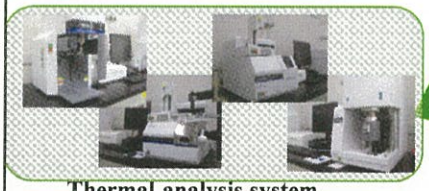
Spark plasma sintering

2008

compression tester

Equipment for evaluation of Taste & Aroma

2010



Thermal analysis system

2011

ITIM

Technical seminars for advanced automotive systems

Continuously Variable Transmission : CVT

Electric motor for HV system

Deepen the understanding of the detailed structures of HV vehicles. Local enterprises would derive a development target from these seminars.

ITIM

Miyagi Automotive Industry Promotion Council

【Overview】 The Miyagi Automotive Industry Promotion Council is composed of members from industry, academic and government bodies. It encourages local companies to enter the automotive industry and promotes business.

Established

Name: Miyagi Automotive Industry Promotion Council
Established: 11th May 2006
No. of members: 509 companies and groups (as of 31st August 2012) (of which 296 manufacturing companies)

Members

Automotive industry companies, companies thinking of expanding into the automotive industry
Universities, financial institutions, government bodies, other groups cooperating with automotive industry promotion

Objectives

Concentrate high-technology, increase order opportunities, regional affiliations, promote financial affiliation of industry, academic and government bodies

Members Fee

* Fees apply to some events/Initiatives

* Fees apply to some events/Initiatives

【Miyagi Automotive Industry Promotion Plan】

The Miyagi Automotive Industry Promotion Council drafted the Miyagi Automotive Industry Promotion Plan in 2012 as a concrete measure to help many local companies enter into the automotive industry. The plan's objective is to increase the number of new orders to local companies for car parts etc., to 300 or more over the course of the next 10 years, with a view to cementing car manufacturing industry in Miyagi Prefecture.

【Main Efforts】

Acquisition of Orders

▼Excelling Technology Discovery Initiative
▼Automobile Parts Function and Production Research Initiative
▼Value Analysis Investigative Commission Implementation Initiative
▼Automotive Industry Seminar Implementation Initiative
▼Business Matching Support Initiative
▼Reverse-exhibition and Business Discussion Implementation Initiative
▼Production Site Improvement Initiative

Human Resources Development

▼Miyagi Car-intelligent Human Resources Development Initiative
▼ Automobile Design/Development Personnel Training Project Financial Support Initiative
▼Automotive Industry Seminar Implementation Initiative
▼Production Site Improvement Initiative (Intensive Training)
▼Human Resources Development Training of Young Persons to Work at Automobile-related Companies
▼Toyota East Japan Technical Skills Academy Affiliation Initiative

Technology Development

▼New Technology/ Construction Method Research Development Promotion Initiative
▼Toyota Motor East Japan Technology Centre and Tohoku Affiliation Initiative
▼Tohoku University etc. Affiliation Initiative
▼Regional Innovation Strategy Support Programme
Next Generation Automobile Miyagi Prefecture Area (Human Resources development/Machinery and tools sharing)

Objective

300 cases or more in the 10 years from 2012

Objective

Office: Automotive Industry Development Division, Commerce, Industry and Tourism Department, Miyagi Prefecture, Tel.: 022-211-2724
www.pref.miyagi.jp/jidousha/mjk_index.htm

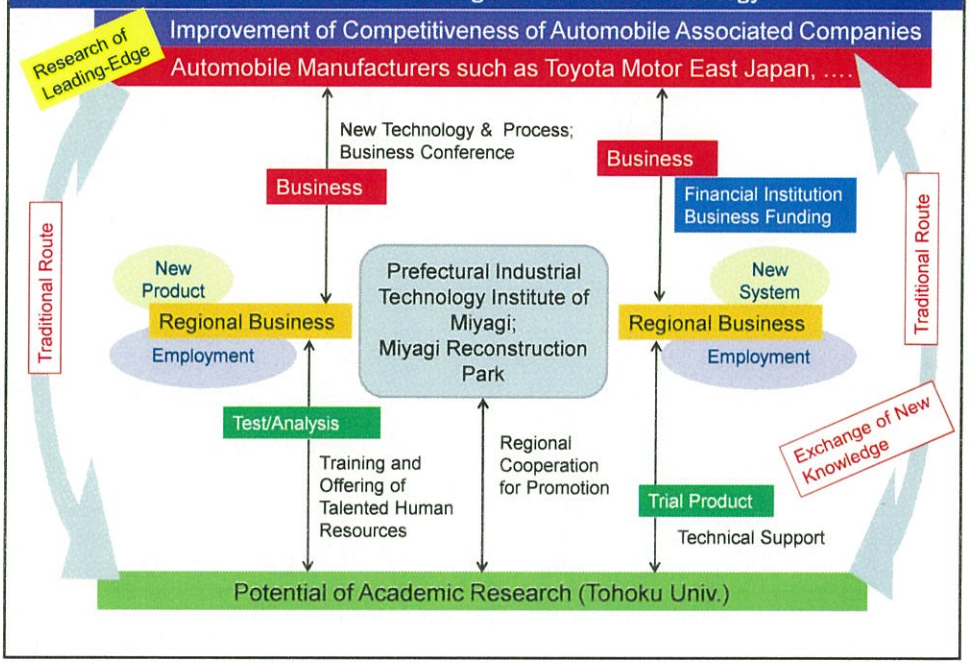
Next Generation Automotives: Goal of National Project

1. Expected Mission of Tohoku University, as one of the Most Active Research Universities, after the Big Earthquake/Tsunami
2. Global/Local Importance of Automotive Industry
3. Organization to realize Simultaneous Global/Local innovations.
4. Research/Technological Potentials in Tohoku University for the Next Generation Automotives.
5. Activities of Local Government, Bank, Local Bureaus of Central Governments, Local Capitals, Local Economic Organizations, and Local Companies.
6. Programs and Coordinators
7. Concluding Remarks

Programs and Coordinators in the Project

- In the present project, more than 40 laboratories in Tohoku University and members of ITIM perform the following programs: (1)collaborations through human resources development and (2)collaborations through the use of advanced apparatus/instruments. Many coordinators in the local governments, the local organizations and Tohoku University promote collaborations among different laboratories and companies for next generation automotives.

Industry-Academia-Government Innovation for Next Generation Automobile 75
- Overall Mechanism of Regional Innovation Strategy -



Industry-Academia-Government Innovation for Next Generation Automobile 76
- Overall Mechanism of Regional Innovation Strategy -

Next Generation Automobile Innovation Promotion Council

Round Table
Governor of Miyagi Pref.
Mayer of Sendai-city
President of Tohoku Univ. and Chairman of Tohoku Economic Federation

Project Operation Board
Worldwide Technology Trend Research Unit
Business/Commercialization Promotion Committee
Intellectual Property Committee
Regional/Wide Area Cooperation Promotion Committee
Research Promotion Committee
Progress Evaluation Committee
Publicity Committee
Intelligent Cosmos Research Institute

External Evaluation Committee

Advisory Board

(International Research Institute of Disaster Science at Tohoku University)

Organization for promoting Industry-Academia-Government Cooperation

The 77 Bank; Sendai-city; Tohoku Bureau of Economy, Trade and Industry; Business Center of Tohoku Economic Federation;
Miyagi Organization For Industry Promotion (Miyagi Reconstruction Park); Miyagi Industrial Association; Automotive Industry Development Division of Miyagi Pref.; Sendai City Industrial Promotion Organization, etc.;
Tohoku Innovation Capital;
Universities & Colleges; and Tohoku Center of National Institute of Advanced Industrial Science and Technology, etc.

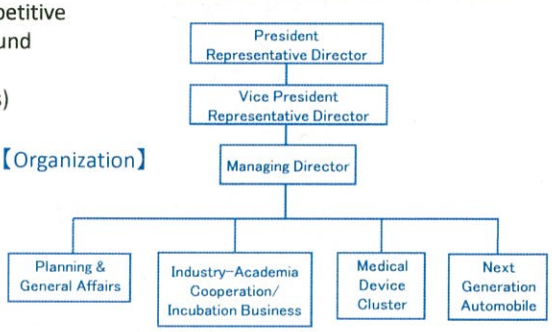
Cooperation with other regions in Tohoku District headed by Iwate Pref.

ICR
Intelligent Cosmos Research Institute

【Company Information】
- Funded Feb. 10, 1988
- Capital JPY8,456,500,000
- Employees 38

【Business】
- Promotion of Industry-Academia Cooperation with use of competitive fund such as Governmental Fund
- Leasing R&D facilities (Support to venture business)

【Organization】



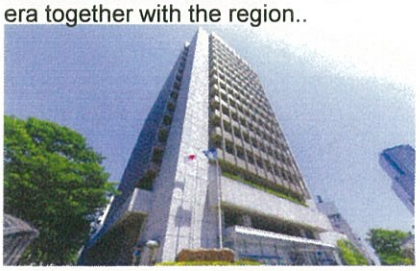
Growing with the Region
The 77Bank,Ltd.

Profile

Founded : Dec. 1878
Capital : ¥24.7 billion
the largest bank in TOHOKU
Branches : 141
Employees : 2,898

Philosophy

The 77 Bank continues to strengthen its business foundation and enhance its management quality in order to be the **"Best creative bank"** that creates a new era together with the region..



Our mission, as a regional financial institution, is to contribute to regional socioeconomic development
through the timely and accurate provision of financial services geared to the needs of the region.
Our efforts have earned us the support of customers, boosting our regional share of deposits and loans
to the highest level among Japanese regional banks.

Agreement with Tohoku University

Tohoku Economic Federation (Tokeiren)

■Tokeiren(Tohoku Economic Federation)
(1)Members: Comprised of approximately 800 companies and organizations working to develop and expand economic activities in the seven prefectures of the Tohoku region.
(2)Established: December 1966
(3)Chairman: Hiroaki Takahashi(chairman, Tohoku Electric Power Co., inc)
(4)Activity Objectives:
①Investigate and research various issues related to domestic industries and the economy, gather a consensus of opinions and recommendations on the Tohoku economy and strive to achieve objectives based on these activities.
②Contribute to the development of the Japanese economy and society through economic stimulation and consensual regional development of the Tohoku region.
③Make policy recommendations and promote projects through the nine committees that comprise TOKEIREN. Great East Japan Earthquake and Tsunami Reconstruction Measures, economic policy, industrial policy, transportation and shipping, information and telecommunications, environmental resources and energy and tourism and culture.

社団法人 東北経済連合会

■Tohoku Vision for 2030
-Tohoku Towards the pivotal place of innovation in East Asia-
(Future Vision)
・Realizing richness and growth in Tohoku
・Realizing healthy and lively lifestyle in Tohoku
・Fulfilling the hopes and dreams of young people

(Strategies)
・Industrial Innovation for encouraging new growth
・Network Innovation for opening to East Asia
・Human Capital Innovation for region`s attractiveness
・Regional Management Innovation for regional independence

■Other Policy recommendations
・Policy Recommendation to the Central Government for the Great Earthquake and Tsunami
・ Inviting the International Linear Collider Project
・Promoting Natural Innovation using region`s natural resources
・Recommendation to the Central Government for economic policies and industrial policies

社団法人 東北経済連合会

Next Generation Automotives: Goal of National Project

1. Expected Mission of Tohoku University, as one of the Most Active Research Universities, after the Big Earthquake/Tsunami
2. Global/Local Importance of Automotive Industry
3. Organization to realize Simultaneous Global/Local innovations.
4. Research/Technological Potentials in Tohoku University for the Next Generation Automotives.
5. Activities of Local Government, Bank, Local Bureaus of Central Governments, Local Capitals, Local Economic Organizations, and Local Companies.
6. Programs and Coordinators
7. Concluding Remarks

Concluding Remarks

International collaborations are highly important to deepen our understanding/methodology and promote simultaneous global/local innovations