Creation of a Global Base for Advanced Metals – Next Generation TATARA Project –
Development of Human Resource is the Backbone of Future Manufacturing: “Establishment of a Specialty Metal Base Attracting People Globally”

Creation of a Global Base for Advanced Metals – Next Generation TATARA Project –

【Matsue College】
- Human development in collaboration with Shimane University
- To encourage students progressing to Shimane University Graduate School

【Shimane University】
- Establishment of "Next Generation Tatara Co-Creation Center"
- Establishment of new departments and graduate courses

Supplying HR & Research outcomes

Virtuous cycle

Supporting HR development & Joint R&D

- University of Oxford
- Tokyo Institute of Technology
- Gifu University
- Kumamoto University

≪Boosting specialty metal industry≫
- Materials-driven business expansion:
  ✓ Super heat-resistant alloys → Main components of aircraft engines
  ✓ Amorphous metal ribbons → Energy efficient cores of motors

Shimane:
The center of advanced metals with intertwined global networks

Spearheads of casting, metal processing, automotive parts processing, software-related IT and other industries
**Specialty Metal-related Companies in Shimane**

### Hitachi Metals’ Group Businesses

- **Specialty metal products manufactured by Hitachi Metals**
  - Jet engine components
  - Amorphous metal ribbons
  - FINEMET*: Nano-crystalline ribbons

- **Large-scale equipment at Hitachi Metals Yasugi Factory**
  - 24t large-scale vacuum melting furnace
  - 10,000t large-scale pressing machine
  - 1,800t large-scale four-side forging machine
  - Casting tool steel
  - CVT belts
  - Laminated metal foil

### SUSANNO

#### Past and Present of SUSANNO

- Oct. 2013: “SUSANNO” was launched by 6 small and medium-sized companies signed up to “Aircraft Working Group” of the Promotion Council.
- Jan. 2015: One additional company participated and SUSANNO expanded to 7 SMEs.
- Mar. 2015: SUSANNO consortium rules, systems, etc. were adopted.
- Apr. 2015: SUSANNO dedicated sales staff were appointed in Nagoya and joint sales were commenced.

#### Technology

SUSANNO has in-depth experience in processing heat-resistant specialty metals.

**With the Tatara Project, Shimane Prefecture will be the global base of specialty metal supporting sustainable growth of the society**
Overview of the Next Generation Tatara Co-Creation Center

Target

- Advancement of R&D in aircraft and motor fields
- Educating future specialists in materials field

Long Term
To nurture innovation in the materials industry and establish a globally-competitive R&D center

Governance Structure

Director
Prof. Roger Reed

Vice Directors
2 appointees (one from industry)

Co-creation by multi-discipline researchers from industry and academia

1 industry-academia collaboration coordinator from industry

2 Invited top-level Researchers (mechanics of materials, alloys design from Oxford University)

9 Invited Researchers (heat-resistant alloys, magnetic materials, casting, forging, special processing, etc.)

13 or more existing researchers (material evaluation, material property, nanomaterials, fluids, magnetic property, information technology, etc.)

3 or more external collaborators from other universities (plastic forming, material strength, structural material, etc.)

Main equipment

In-situ observation of atomic-nano level deformation processes

Advanced vacuum solidification simulator

At Shimane University, students experience kneading the clay preparing the furnace in a practical training.

Invited Researchers from University of Oxford
Department of Materials

- Oxford
  Heat resistant alloys field

- Tokyo Tech
  Aircraft field

- Gifu U.
  Metal processing

- Kumamoto U.
  Micro strength evaluation

Joint researchers (industry)

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- Professor
  Dr. Roger Reed

- Associate Director of Engineering
  Dr. Fauzan Adziman

- Innovation Fellow
  Dr. C. Panwisawas
Targets: Super heat-resistant alloys for aircrafts, Amorphous alloys for motors

Atomic- to nano- to micro-level metallographic analysis technology:
The World’s Most Advanced Level

Shimane University
• Atomic- to nano-level dynamic metallographic analysis using transmission electron microscope (TEM) (Science (2007) (citation: 174), invited lectures at international conferences, etc.: 33

Role: Further advancement of analysis technology ⇒ Extending application to product development

Innovation through mutual collaboration

Role: World-leading R&D principles

University of Oxford
Heat-resistant alloy technologies using computational approaches (textbook: “The Superalloys”)

Role: Process development, verification if the products are manufacturable, industrial practice

World-leading advanced alloys technologies:
The Worlds’ Most Advanced Level

Hitachi Metals
Proven track records in creation of high added-value materials, obtaining of certifications and commercialization of new materials.

Large-scale controlled production of super alloys, etc.: The World’s Most Advanced Level
Next Generation Tatara Co-Creation Center

**Aircraft industry project**
- Super heat-resistant alloys
- 100% domestic production of key aircraft engine components
- Integrated production system for aircraft parts

**Motor industry project**
- Amorphous metal ribbons
- Development of world-class high-efficiency motor cores
- Technology transfers to companies in the prefecture

**HR development project**
- Establishment of new departments and graduate courses
- To train engineers to become active internationally
- To increase the number of students finding jobs at local-grown companies

### Project Themes and Targets

#### Improvement of the added value to the materials business
- Advancement of industries by utilizing local materials and materials evaluation technology
- Increases of the number of advanced professionals finding jobs at local-grown companies

#### Enrichment of materials

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<th>Production of Materials</th>
<th>Rough Processing</th>
<th>Intermediate Processing</th>
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1. Establishment of an integrated production system
2. Current state = Expanded part

#### Effort of Industry
- Advancement of industries in Shimane prefecture, entry of companies from outside the prefecture
- Industrialization of large projects
- Development and expansion of key industries
- Industrialization of research results
- Activation of joint research
- Project with Subsidy

#### Effort of Academia
- Stable output of highly advanced professionals
- Generation of research results
- Establishment of a top-level research center
Challenges that the world's aircraft-engine industry are facing

- To optimize advantage from the market expansion (annual growth rate of 5%)
- Materials for aircraft-engines are currently produced predominantly in limited area (only in Europe and North America)
- Improvement of fuel consumption performance/reduction of the environmental effects
- Improvement of production efficiency/cost reduction

Industry requirements

- Development of fuel-efficient engines (large-sized, improvement of heat resistance properties)
- Closed-loop recycling of materials (to set up an integrated production system in Asia)

Shimane Prefecture’s approach

- Development of new materials for jet engines
  ... Reduction of the effect on environment
- Development of manufacturing technologies for large parts
  ... Improvement of performance
→ R&D in collaboration with Shimane University, University of Oxford, Hitachi Metals, Ltd., and other

- Establishment of integrated production system (from “production of raw materials” to “finishing/machining” and also “recycling”)
→ Technological advancement of companies in the prefecture
+ To attract companies to improve manufacturing processes

Realization of Asia’s first aero-engine cluster for materials manufacturers

- Processing company
- Hitachi Metals
- Universities
- Money and banking
- Public administration

Performance improvement of the heat-resistant alloy is the key to the improvement of fuel efficiency!
Current Status of the Motor Industry and Efforts of Tatara Co-creation Center

Challenges that the world's motor industry are facing

- To optimize advantage from expansion of the motor market (EV, household appliances, drones, etc.)
- Reduction of the environmental effects
- Improvement of production efficiency/ reduction of costs

Industry requirements

- Development of high-performance motors (smaller-size, higher output, low-noise, low vibration, etc.)
- Energy saving
- Enhancement of the general versatility/ reduction of rare earth elements

Amorphous metal ribbons

Excellent soft magnetism
- low loss
- high magnetic permeability

low-heat-generating

high-efficiency/ high-revolution

small-size/ high-power density

Shimane Prefecture’s approach

Mass production of amorphous cores

- Establishment of mass production technologies
- Material improvements of amorphous metal ribbons (thickening etc.)

→ R&D with Shimane University, Kumamoto University, Gifu University, Hitachi Metals, Ltd., University of Oxford, etc.

Formation of unit clusters

Establishment of mass production base for amorphous cores

Cooperation with motor-related companies in the prefecture

Motor production base

To attract motor manufacturers

Motor core
Towards World-Leading Co-Creation Center in the Materials Field!!

Establishment of a sustainable circular economy from Shimane Prefecture!!

Key Success Factors

- **Materials Innovation** nurtures the innovation of products, processes and systems
- **Technology Pull** research stimulates creation of products required by industry
- Selection of key themes which excites **Mutual Benefit** is the key to success
- By virtue of world-class **Co-Creation** to achieve **Value** beyond today’s imagination

Your passion will create the future of Tatara Center!