World Premier International Research Center（WPI）

Advanced Institute for Materials Research（AIMR）

AIMR aims to establish a Premier Research Center for materials science, to reform the conventional Japanese system, and to construct a visible center. To achieve this goal, excellent researchers in the fields of materials science, physics, chemistry, engineering and mathematics will come together under the environment appropriate to a top world-level research center.

A mathematical viewpoint is added to identify common principles behind all kinds of materials and all layers and to elucidate common mathematical principles, as well as eventually to establish a new path to “materials science research with an added mathematical viewpoint.”

AIMR creates new fundamental paradigms and also promotes the application of research projects with new materials and system architecture, which generates direct societal impacts especially for green innovation; thus exhibiting the qualities necessary to become a world-leading international center of materials science.

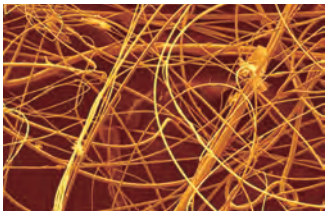
Bulk Metallic Glasses
This division is dedicated to the cutting-edge research of advanced non-equilibrium metallic materials including amorphous, quasicrystalline and nanostructured metals and alloys that exhibit unique and superior physical, chemical and mechanical properties.

Materials Physics
Exploring and understanding innovative materials for electronic devices are the key targets in the research of division.

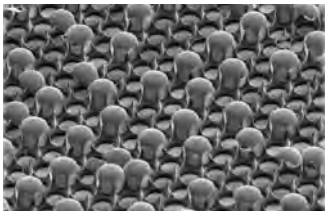
Soft Materials
Synthesis, characterization and evaluation of soft materials, such as organo-π-electronic devices, gel, polymer composites, microporous polymer films, and nano-structured materials catalysts, are key issues of this division.

Device/System
Our device/system group consists mainly of spintronics, electronics, MEMS materials and bio device laboratories. Fabrication of innovative materials and developing them to devices are key target of our group.

Mathematics Unit
Mathematical Unit gives a viewpoint beyond various levels of hierarchy of the outcomes of materials science and builds a new scientific principle in cooperation with Groups of Bulk metallic glasses, Materials physics, Softmaterials and Device/Construction.



Gas atomization allows the massive production of amorphous alloy nanofibers.



High adhesive superhydrophobic metal–polymer hybrid surfaces prepared by self-organization

Advanced Research and Development Support Program

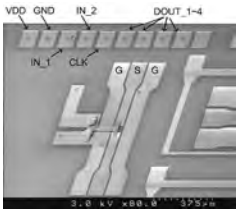
FIRST Program
Funding Program for World-Leading Innovative R&D on Science and Technology

The FIRST Program, dealing with various fields of study and stages such as basic research creating new knowledge and research development aiming for specific goals, is a research and development support program promoting advanced research which aims to reach top world level within 3-5 years. 30 leading-edge research development themes or involved core researchers were selected by the Council for Science and Technology Policy. From Tohoku University the following 2 themes were accepted.

Research and Development of Integrated Microsystems

Masayoshi Esashi（Director of Micro System Integration Center（μSIC））
（Research and development Overview）

Value added components which play important roles in systems can be fabricated by integrating heterogeneous parts on semiconductor integrated circuits. This contributes to the worldwide society in microelectronics field.

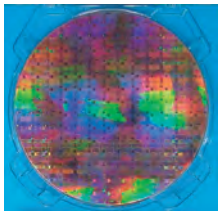


The piezoelectric switch fabricated on an integrated circuit.

Research and Development of Ultra-low Power Spintronics-based Logic VLSIs

Hideo Ohno (Director of Center for Spintronics Integrated Systems)
(Research and development Overview)

Making use of the electron characteristic called spin, we will develop semiconductor logic integrated circuits using spintronic elements capable of storing data without need of extra energy and through this Japan will leap ahead of other countries. We will link our results to the development of electronic devices that use a smaller amount of energy compared to former technology and contribute to the realization of a green society.



Photograph of 300-mm wafer on which spintronics-based VLSI test chips were fabricated.

Advanced Research and Development Support Program

NEXT Program
Funding Program for Next Generation World-Leading Researchers

The Next Program is a research support system targeting promising young researchers, female researchers in particular and researchers working at regional research institutes. The selection process takes into consideration the researchers' gender, the regional nature of the researchers and the research content ranging from basic research on green/life innovation up to applied research, including humane and social sciences. 329 research themes including 31 themes submitted by Tohoku University were selected.

Green Innovation

Name	Affiliation	Project Title
Koshi Adachi	Graduate School of Engineering	Optimization Technology of Nanoscopic Interface for Low Friction Systems and Tribologically-based Machine Design
Kazuya Ando	Institute for Materials Research	Ultralow-power information processing device based on spin-wave spin current
Takuji Ishikawa	Graduate School of Engineering	Innovation of an algal suspension model based on cellular biomechanics of microbes
Shin-ichi Orimo	Institute for Materials Research	Discovering Properties of Hydrides -from Basic Research on Hydrogen States to Energy-Device Demonstrations
Naomi Kitakawa	Graduate School of Engineering	Development of sustainable green technology for simultaneous production of high quality biodiesel and health enhancing compounds
Momoji Kubo	Graduate School of Engineering	Development of Multi-Physics Simulator Based on First-Principles Molecular Dynamics Method and Design of Low-Carbon Mechanical System
Hitoshi Takamura	Graduate School of Engineering	Innovation in Oxygen-Enhanced Combustion by Fast Oxygen Permeable Membranes
Keiichi Tomishige	Graduate School of Engineering	Catalyst development for the production of biomass-derived chemicals as a substitute of petrochemicals
Toshihiko Hirooka	Research Institute of Electrical Communication	Research and Development of Ultrahigh-Speed and High-Efficient Coherent Optical Transmission Technologies for Green ICT Social Infrastructure
Hiroyuki Fukuyama	Institute of Multidisciplinary Research for Advanced Materials	Innovative crystal growth processes of nitride semiconductors based on their physical chemistry
Asaya Fujita	Graduate School of Engineering	Materials development for realization of magnetic refrigeration satisfying both the reduction of fluorocarbon greenhouse gases and the energy saving
Kozo Fujiwara	Institute for Materials Research	Development of a Crystal Growth Technology for Obtaining High-Quality Si-Multicrystal-Ingots for Solar Cells
Kyosuke Yoshimi	Graduate School of Environmental Studies	Development and Assessment of Ultra-High Temperature Materials with Ultimate Heat-Resistant Properties
Yutaka Miyazawa	Graduate School of Life Sciences	Elucidation of molecular mechanism of root hydrotropism and its application to innovative plant growth regulation

Life Innovation

Name	Affiliation	Project Title
Atsushi Konno	Graduate School of Engineering	Development of a Brain Surgery Simulator using Haptic Devises
Masashi Konyo	Graduate School of Information Sciences	Studies on Motor Function Support Using Enhancement and Transfer of Cutaneous Sensation
Hitoshi Shiku	Graduate School of Environmental Studies	New Instrument system to evaluate mammalian embryos and stem cells based on single-cell analysis
Mami Tanaka	Graduate School of Biomedical Engineering	Creation of QOL technology based on tactile and touch feelings
Kaoru Tamada	Research Institute of Electrical Communication	Innovative NanoBio Detection with Plasmon Nanoantenna
Akira Yoshikawa	Institute of Multidisciplinary Research for Advanced Materials	Systematic study of infrared photon emitting scintillators for cancer therapy
Yoko Aoki	Graduate School of Medicine	Molecular basis of disorders with dysregulated RAS-MAPK signaling
Sumio Ohtsuki	Graduate School of Pharmaceutical Sciences	Development of protein-based innovative diagnosis for personalized cancer therapy
Asako Sugimoto	Graduate School of Life Sciences	Spatio-temporal regulation of cell polarity and cell shape during embryogenesis
Koji Tamura	Graduate School of Life Sciences	Molecular basis of blastemal stem cells for morphogenic organ regeneration
Hidetoshi Tokuyama	Graduate School of Pharmaceutical Sciences	Innovation in Drug Synthesis for Step-Economical Process
Keiko Nakayama	Graduate School of Medicine	Transcriptional repression across a broad range of chromosome by oncogene, RAS
Satoshi Fukumoto	Graduate School of Dentistry	Control method and understanding of tooth morphogenesis associated with disease
Tamaki Yano	Graduate School of Pharmaceutical Sciences	Induction of Autophagy and its Function in Tissue Homeostasis in Innate Immunity
Mari Yamashita	Graduate School of Agricultural Science	Elucidation of biosynthesis, accumulation and transformation systems of the marine toxins concerning to food poisoning, and its application to food hygiene
Naoki Watanabe	Graduate School of Life Sciences	Elucidation of mechanosense cell signaling by fluorescence single-molecule imaging of actin polymerizing machinery
Takashi Tsukiura	Institute of Development, Aging and Cancer	Research for the effects of aging on neural mechanisms underlying human memory processes and the potential application

※Affiliated department at time of application