Doctoral Program in Materials Innovation

Field of Research	Faculty	Detailed Description of Research Field
Energy Materials Engineering	SUEMASU Takashi	High-efficiency thin-film solar cells, thermoelectric devices, and spintronics materials using safe, stable, and abundant elements.
	NISHIBORI Eiji	Structural Materials Science: Structural materials science using advanced x-ray region photon sources. Ultra-high resolution charge density study; In-situ observation of nano-particle synthesis; structural studies of thermoelectrics, battery materials, molecular functional materials. International research collaboration using research unit project.
	MORITOMO Yutaka	Energy materials science: Research of the energy materials and devices, such as, sodium-ion secondary battery, perovskite solar cell, thermoelectrics, catalyst, superconductor, and so on with use of Synchrotron-radiation X-ray (SPring-8, PF) and nano probes (NIMS), and so on.
	SAKURAI Takeaki	Development of highly efficient organic and inorganic thin-film solar cells. Characterization of defects in power semiconductor devices.
	TOKORO Hiroko	Development of novel materials with advanced light-responsive functionalities, accompanying changes of optical, magnetic, and electric properties. Metal complexes and metal oxides are the main target materials
	SUZUKI Yoshikazu	Development of new inorganic materials for energy and environmental applications such as solar cells and environmental purification filters
	HADA Masaki	Femtosecond time-resolved electron diffraction measurements: filming “molecular movies” of photo reactive or responsive materials, Terahertz-wave engineering.
	MORI Takao (NIMS)	We focus on developing highly functional energy environment materials, such as, thermoelectric and battery materials, through atomic network control, synthesis of new materials, nano/microstructure control of materials with strong structure-property relationships from their topology.

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	INOUE Isao (AIST)	Ultra-low-power IT is an urgent necessity, and we challenge the problem by mimicking the brain. Artificial neurons/synapses and their circuits are in development with new materials and physics POV.
	YU Denis Y. W. (NIMS)	Synthesis and characterizations of battery materials: study the effect of surface chemistry and structure on electrochemical performance, long-term stability and safety
	TAKAHASHI Yukiko (NIMS)	Research on functional magnetic thin films for magnetic storage and permanent magnet etc. To improve the magnetic properties, we focuses on the relationship of microstructure, magnetic properties and magnetization dynamics.
	SEPEHRI AMIN Hossein (NIMS)	Studies on high-performance magnetic materials for green energy conversions and data storage applications using a combinatorial research approach, i. e. multi-scale microstructure characterizations, micromagnetic simulations, data science, and materials processing.
	SAKAKI Kouji (AIST)	We focus on material development of hydrogen storage materials for hydrogen storage, compression and purification. In addition, we clarify hydrogen storage mechanism based on structure analysis.
	OHKUBO Isao (NIMS)	Development of novel functional materials and devices by utilizing the various informatics approaches and nanoscale-controlled thin-film growth techniques is carried out.
	ITO Yoshikazu	Development of novel metal/carbon nanoporous materials for realizing sustainable societies and creation of new energy devices.
Environment-friendly Materials	YAMAMOTO Yohei	Self-assembly of π-conjugated molecules, polymers, and biomolecules to construct electronic, optical, and energy conversion devices.
	SAKAGUCHI Aya	Environmental dynamics using stable/radio- isotopic composition and chemical speciation analyses.
	SHIRAKI Kentaro	Technology of protein folding and application of biomaterials

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	KONDO Takahiro	Formation and application of new two-dimensional material of boron, development of a substitute material of Pt at the Fuel Cell electrode using nitrogen-doped carbon, and reaction dynamics at surface based on the fine experimental measurements.
	SASAMORI Takahiro	Main group element chemistry. Creation of novel compounds with unique chemical bondings by utilizing element properties. Development of unique organic reactions with main group element compounds.
	TSUJIMURA Seiya	Electrochemistry of redox enzymes and its application to biosensors and biofuel cells
	OISHI Motoi	Development and design of novel point of care testing (POCT) devices and nano-machines based on DNA nano-system.
	KUWABARA Junpei	Development of new molecular catalysts, facile synthetic methodology for conjugated molecules, and luminescent metal complexes.
	YAMAGISHI Hiroshi	We develop novel molecular crystals with distinct structural flexibility by assembling the constituent molecules via extremely weak intermolecular interactions in a programmable manner.
	NAKAMURA Takashi	Precise construction of functional molecules based on supramolecular chemistry, and exploration of their properties such as molecular recognition and selective reaction. Studies on supramolecular metal complexes utilizing organic ligands and metal ions.
	KUSHIDA Soh	We aim to achieve light-matter strong coupling systems by self-assembly of organic molecules for the novel quantum device applications.
	TAKEUCHI Masayuki (NIMS)	Creation of new organic nanochemistry thorough the design, synthesis, and characterization of organic, macromolecular, and supramolecular materials with photo- and electro-active components, chemosensing functions, dynamic mechanical characters.
	NAITO Masanobu (NIMS)	Development of functional polymer materials using machine learning and smart labs. In particular, we will create innovative composite materials that support people's safety and security through the development of bonding and coating materials with different materials, antibacterial, antiviral, and superhydrophobic materials.

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	HIMEDA Yuichiro (AIST)	Design and development of organometallic catalysts for carbon dioxide conversion and hydrogen storage. Methanol synthesis at low temperature from carbon dioxide. Hydrogen production from formic acid.
	AOKI Hiroshi (AIST)	Novel biomarker sensing contributing to environmental and biomedical fields, focusing on functional molecules responsive to molecular recognition and their applications to biomarker detection devices.
	NORIKANE Yasuo (AIST)	Photofunctional organic molecules especially showing photo-induced solid-liquid phase transitions and lightdriven mechanical motion.
	SHRESTHA Lok Kumar (NIMS)	Fabrication of fullerene-based new functional nanomaterials using nanoarchitectonics concept. We produce ultra-high surface area nanoporous fullerene crystals, and convert them into hierarchically porous carbon materials by high temperature heat treatment for the high-performance supercapacitor and vapor sensing applications.
	KATSURA Yukari (NIMS)	Design of inorganic functional materials database for experimental materials informatics. Searches for new inorganic crystals and new thermoelectric materials by data science, first-principles calculation and experiments.
	TANG Daiming (NIMS)	Development of carbon nanotube (CNT) molecular junction based ultimate nano-transistors and nano-electromechanical systems (NEMS). Atomic characterization and properties measurement of nanostructures and nanodevices by advanced in situ transmission electron microscopy (TEM).
	WEI Qingshuo (AIST)	We aim to understand the doping mechanisms of organic semiconductors, develop new materials and design devices based on them, and to commercialize organic thermoelectric devices and thermoelectrochemical cells.
	PARAJURI Durga (AIST)	We focus on the development of porous materials to tackle challenges in energy and environmental sustainability. We integrate basic and applied research, fostering collaboration between academia and industry.
Electronic Materials	HASE Muneaki	Ultrafast laser spectroscopy on semiconductors and dielectric materials using femtosecond laser and application to optical devise and controlling phase transitions

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	YANAGIHARA Hideto	Thin film growth of advanced magnetic oxides for spintronics devices
	OKADA Susumu	Using the first-principles techniques based on the quantum mechanics, we study physical and chemical properties of nanoscale materials, ranging from the semiconductor to biomaterials.
	OHNO Yuzo	Studies of electronic, optical, and spin properties of semiconductor nanostructures, and spin coherence for quantum information and low-power devices.
	MARUMOTO Kazuhiro	Development and characterization of semiconductor materials, and their application to semiconductor devices such as solar cell, light-emitting diodes, transistors, etc. using functional materials such as organic materials, perovskites, low-dimensional materials, etc.
	TAKEUCHI Osamu	Development of new microscopy techniques by combining nanometer-resolving scanning probe microscopy and optical measurement techniques, in order to reveal nanometer-scale optoelectronicprocesses in solar cells, light emitting diodes, and spintronics devices and to improve their device performance
	FUJIOKA Jun	Research on electronic, optical and thermal property in strongly correlated electron material and topological quantum material. Searching new quantum phenomena and functions by using state-of the art material synthesis technique, spectroscopy and fundamental characterization.
	YAMADA Yoichi	Basic researches on next-generation materials in organic and hydrogen nanotechnology. Nano- scale engineering utilizing self-organization phenomena.
	GAO Yanlin	Electronic structure theory. Computational material science. To reveal and predict the electronic and geometric structures of new carbon related materials based on the quantum theoretical approaches. Theoretical prediction of electronic properties of nano-scale structures on surfaces and interfaces.
	YUASA Shinji (AIST)	Research and development of magnetic tunnel junctions, magnetoresistive random access memory MRAM and other spintronic devices.

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	TAKANO Yoshihiko (NIMS)	We are focusing on the physical properties of high-Tc superconductor, diamond superconductor, Fe-based superconductor and carbon nanotube. Development of novel devices, including optical and field effect devices, using superconductors and nano-technologies are targets.
	MITANI Seiji (NIMS)	Development of magnetic materials and nanostructures by Atomic scale control based on state-of-the-art thin film growth techniques. Searching and understanding new functionalities in spin transport and their application to Spintronic devices.
	HIRANO Atsushi (AIST)	We explore the interaction mechanisms between nanomaterials and biomolecules to understand the biological behavior of nanoparticles and develop novel composites. While our primary focus lies on nanocarbons and proteins as targets, we also extend our exploration to a diverse range of materials.
	EDWARDS Thomas (NIMS)	We investigate the fundamental deformation mechanisms of crystalline and amorphous matter, from nano- to macro- lengthscales, to improve mechanical properties in extreme application conditions across a broad range of materials, from engineering alloys to functional ceramics or polymers.
Synchrotron-Radiation Materials Engineering	AMEMIYA Kenta (KEK)	Elucidation of the function expression mechanism by operando observation of surface and interface using quantum beams.
	KUMAI Reiji (KEK)	Study using quantum beams such as synchrotron radiation to reveal the origin of macroscopic physical properties from the microstructure inside materials in condensed matter.
	YOKOO Tetsuya (KEK)	The dynamics in functional materials, in particular high-Tc superconductors and quantum spin systems are the target of research. Neutron scattering technique is utilized as a probe, also physical thermodynamic quantities will be measured to elucidate the mechanism in materials.

(Note)

- Applicants should have a thorough discussion with a professor of their research field about your research plan in advance.

Inquiries about the entrance examination should be sent to:

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(NIMS)＝The National Institute for Materials Science
(KEK)＝High Energy Accelerator Research Organization