Doctoral Program in Materials Innovation

Name of the degree to be conferred	Doctor of Philosophy in Engineering
Educational purpose	The Doctoral Program in Materials Innovation has committed tie-ups with research institutes in the Tsukuba region to cultivate educators, researchers and highly specialized professionals who lead the innovation for building a better and advanced materials' society from a higher perspective that can see environmental and energy problems and other global scale issues using their basic knowledge in a wide range of natural sciences of different disciplines.
Vision of human resources development	He or she should possess advanced abilities as to materials, lead the innovation in the future-oriented innovative energy materials, environmental materials chemistry and electronics, and create ideas for global scale social needs to be active as a leader in the international society by getting their English proficiency into full use.

Competencies specified in diploma policy	Evaluation perspectives
1. Knowledge creation competence: Ability to create new knowledge that can contribute to future society	①Are there any research findings that can be considered new knowledge? ②Can we expect you to create knowledge that will contribute to future society?
2. Management competence: Ability to plan and implement measures to identify and solve challenges from a higher perspective	①Can you make and implement long-term plans for critical challenges? ②Can you identify challenges, even in other areas of expertise, and solve them from a higher perspective?
3. Communication competence: Ability to express the true nature of academic findings positively and clearly	①Can you explain the true nature of research content and specialized knowledge clearly and logically to researchers from different areas and to people other than researchers? ②Do you proactively share your findings with researchers and experts from your field of expertise and accurately answer questions?
4. Leadership competence: Ability to have objectives get accomplished under your leadership	①Can you set attractive and compelling goals? ②Are you capable of building systems to realize goals and accomplish objectives as the leader?
5. Internationality competence: Possession of a high level of awareness and motivation to be internationally active and contribute to international society	①Do you have strong awareness and motivation to contribute to international society and international activities? ②Have you obtained adequate linguistic skills for international information collection and action?
6. Theoretical design ability: Ability to design materials based on quantum mechanics or thermodynamics	①If the ability to design materials based on quantum mechanics was gained ②If the ability to design materials based on thermodynamics was gained
7. Analytical ability for materials functionalities: Ability to elucidate materials functionalities at the molecular and electron level using synchrotron radiation materials analysis, scanning probe microscopes and other analytical instruments	①If the ability to elucidate materials functionalities at the molecular and electron level using synchrotron radiation materials analysis, scanning probe microscopes and other analytical instruments was gained
8. Materials creation ability: Ability to create novel materials or high-performance devices	①If the ability to create novel materials or high-performance devices was gained
9. Fundamental engineering ability: Knowledge, academic abilities and research ethics appropriate to researchers or highly specialized professionals in the areas of engineering	①If the advanced specialized knowledge indispensable as a researcher in the areas of engineering sciences was gained ②If a wide range of specialized knowledge necessary for the applied development of research in the areas of engineering sciences was gained ③ If researcher ethics and engineer ethics were understood and adhered by
10. English negotiation ability: Ability to use English for the active access to researchers in the world to communicate as to research	If one has deep interests in global research trends in the areas of engineering sciences and if the ability to negotiate in English with researchers in the world was gained

Dissertation evaluation criteria

【Review board members】

Structure of thesis review board

Set up with one chief reviewer and three or more sub-reviewers.

【Review method】

Prior to the receipt of a degree thesis, to determine the acceptance of the submission, the degree thesis is preliminarily reviewed.

The thesis review board administers thesis review and the final exam or the confirmation of academic abilities.

【Review items】

1. The research tasks must be set up with ingenuity, and the selection of research methods must be appropriate.
2. The line of reasoning must be clearly developed in English from the objectives of research to the conclusions.
3. The preceding researches related to research tasks must be grasped and understood with appropriate appraisal and citation.
4. With adherence to research ethics, the obtained results and conclusions must be verifiable by third parties.
5. Academic significance must be internationally identifiable in research outcomes.

【Level standards required for the degree thesis】

All of the above evaluation items must be met, and before a dissertation review board is opened, one first-author dissertation must be available to be published or posted in an academic journal. The dissertation passes as a doctoral dissertation with the final exam included in the judgment.

Curriculum Policy

Realms as pillars of education and research: Organized in energy materials engineering, environmental materials engineering, and electronic materials engineering.

The curriculum seeks to develop human resources who can practice engineering application based on pure science by removing the conventional boundaries between science and engineering.

Curriculum organization policy	・Seminars are organized to develop students' practical abilities with a variety of researchers invited as instructors from diverse scenes ranging from pure research to manufacturing and mounting worksites in a tie-up with AIST, NIMS and KEK as well as overseas academic institutes attaining outstanding successes and from industry circles. The curriculum also seeks to cultivate global human resources who are capable of challenging various issues and overcoming them.
Learning methods・Processes	・With Materials Innovation Research IIIA, IIIB, IVA, IVB, VA and VB (Required subject: 3 credits each), students actively deepen the research of their respective area of expertise and focus their energy on accomplishing the world's top research results by seeking to improve the research ability for completing the Doctoral Program. ・Research Proposal (Required subject in the Doctoral Program's first year: 1 credit), which focuses on the setup of students' research themes, is learned in the first academic year of the Doctoral Program. In this subject, each student plans the background, significance, and expected results of research other than own research theme. Students present the proposed research plan in a seminar format in English and hold a discussion to develop the ability to draw up a research plan. The faculty members and all students in the major attend the proposal presentations, have discussions and appraise students' presentations. ・In Open Seminar IIIA, IIIB, IVA, IVB, VA and VB (Required subject: 1 credit each), students participate in the lectures of external researchers active at the world's forefront and seminars with student research presentations and to submit a report as to what they learn. Students also participate in discussion in English actively to gain international communication ability in English. ・With Joint Seminar IIA, IIIB, IVA, IVB, VA and VB (Elective subject: 1 credit each), each student participates in research activities of other laboratories or those overseas over one semester to seek to deepen the research level in their own research theme and extend their interdisciplinary points of view. Students also experience diverse research environments by going to the seminars of other laboratories of areas different from the one that the student belongs.
Evaluation of learning outcomes	・With Materials Innovation Research IIIA, IIIB, IVA, IVB, VA and VB (Required subject: 3 credits each), the acquisition of research ability is evaluated from multifunctional points of view by way of a system of research supervision with multiple supervisory faculty members. ・The specialized ability based on the basic knowledge about materials and the presentation ability in English are evaluated. ・In Open Seminar IIIA, IIIB, IVA, IVB, VA and VB (Required subject: 1 credit each), communication and management abilities in English are evaluated through research presentation in English, serving as a chairperson, seminar arrangement and discussion.

	・Whether the student shows learning outcomes appropriate to a doctoral degree in engineering is evaluated by the review of degree dissertation. ・For the degree dissertation review and final exam, a dissertation review board is set up with one chief reviewer and three or more sub-reviewers. In this review board, achievements are evaluated as the final examination which is administered with a written exam and an oral exam.
Admission Policy	
Desired students	We seek candidates who possess outstanding fundamental abilities and intellectual capabilities and are eager to research with an ambition to become an outstanding researcher in the future. The Program, which is all taught only in English, demands candidates to have sufficient English proficiency.
Selection policy	Potential students are solicited worldwide and selected by an online interview as to the research outcomes that the candidate has earned so far and the post-enrollment research plan. Communication ability in English is evaluated.