

Course number	U-LAS70 10002 SE50				
Course title (and course title in English)	ILAS Seminar-E2 :Nanostructured Materials (ナノ組織材料) ILAS Seminar-E2 :Nanostructured Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,GAO , Si		
Group	Seminars in Liberal Arts and Sciences	Number of credits	2	Number of weekly time blocks	1
Class style	seminar (Face-to-face course)	Year/semesters	2026 ・ First semester		Quota (Freshman) 15 (15)
Target year	Mainly 1st year students	Eligible students	For all majors		Days and periods Tue.5
Classroom	Engineering Science Depts Bldg. Physics 822 (Main Campus)			Language of instruction	English
Keyword	Materials Science / microstructures of materials / properties of materials				
[Overview and purpose of the course]					
<p>The physical properties of materials, such as strength, ductility, toughness and corrosion resistance largely depend on their microstructures - the very small scale (generally smaller than 0.1 millimeter) structures of the material that can be only observed by microscopes. By tuning the microstructures the physical properties of the materials can be greatly modified without changing their chemical compositions. Nanostructured materials refer to the materials having microstructures of which the characteristic length scale is very small, generally in the order of 1 to 1000 nanometers (1 nanometer is equal to 10^{-9} meter). Because of the extremely fine microstructures, the nanostructured materials often exhibit superior physical properties which cannot be obtained from the conventional materials having coarse microstructures. The purpose of this course is to introduce the frontier research of the nanostructured materials with focusing on the microstructures and mechanical properties of nanostructured metals and metallic alloys. For that purpose, the background knowledge of material science and engineering and physical metallurgy will be firstly introduced in the seminar. Examples of the nanostructured materials having excellent properties and the related physical mechanisms will then be introduced and discussed. Laboratory tours are offered to the students to learn the cutting-edge techniques for fabricating and characterizing the nanostructured materials.</p>					
[Course objectives]					
<p>By taking this course, students will learn why the materials researches are going into the length scale of nanometer in recent decades. In addition, they will have a brief understanding on the frontier researches of processing, properties and microstructures of the nanostructured metals and alloys.</p>					
[Course schedule and contents]					
<ol style="list-style-type: none"> 1. Introduction to materials and materials science 2. Atomic structure and interatomic bonding 3. Structure of crystalline solids 4. Imperfections in solids 5. Microstructures of materials and concept of nanomaterials 6. Laboratory tour* (Techniques for evaluating the mechanical properties and microstructures observation) 7. Metallic materials having nanostructures 8-11. Microstructures and mechanical properties of nanostructured metallic materials 12. Laboratory tour* (Techniques for creating nanostructured metallic materials) 					
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13-14. Advanced characterization techniques
15.Feedback

* Two laboratory tours in the 6th and 12th week will be held in the laboratory for structure and property of materials in the Department of Materials Science and Engineering at Yoshida campus.

[Course requirements]

None

[Evaluation methods and policy]

Attendance and active participation [60%]
Final report [40%]

[Textbooks]

Not used

[Study outside of class (preparation and review)]

Students are required to read assigned materials (distributed by the teacher) before and after the class for preparation and review. The necessary time for those would be around 2 hours for each class.

[Other information (office hours, etc.)]

Take out accident insurance. (Students Pursuing Education and Research (Gakkensai)).

[Essential courses]