Course Name	Strengthening Mechanisms of Materials		
Semester, Year	１学期（春ターム）	Number of Credits	2 credits
Course level	6000	Course Number	027016
Instructor(s) (Institution)	Seiji MIURA (大学院工学研究院)		
Course Objectives	Various strengthening mechanisms have been applied for developing alloys. The dislocation theory is a powerful tool for understanding the macroscopic plastic deformation behavior of the metals from the atomic scale viewpoint. Through this course students study mechanisms/models of the behavior of dislocation(s), which are mainly based on elastic energy. Also students study the fracture mechanisms in relation to the dislocation theory. Students will sometimes be required to explain their homework results in this course and to debate on the subjects addressed in the lecture.		
Course Goals	Based on the knowledge on the dislocation theory students are required to construct their ability to be able to discuss on mechanical properties of mainly metallic materials.		
Course Schedule	(1) Advanced elastic theory (2 weeks) Study the definition of stress, strain, elastic energy and relation to thermodynamics (2) Fundamentals of plastic deformations (2 weeks) Study the fundamentals of dislocation theory * Definition of dislocation based on Burgers vector * Strain field of dislocation and the energy of the system * Dislocation multiplication (3) Strengthening mechanisms (8 weeks) Study the strengthening mechanisms and the engineering aspect of strengthening * Strain strengthening and its effect on the high temperature deformation (Creep) mechanisms * Solid solution strengthening * Precipitation strengthening * Effect of grain refinement on the strength (4) Fracture mechanisms (2 weeks) Study the fracture of materials * Stress intensity factor * Weibull distribution (5) Special topic (2 weeks) Study any related hot topic such as the functional materials related to the dislocation behaviors.		
Homework	1 hour-home works in average.		
Grading System	Based on the discussion in the course as a result of homework (40%) and final examination (60%). Final examination is the presentation and discussion on a published literature (a technical paper) related to the subjects of this course.		
Textbooks / Reading List	Mechanical metallurgy George E. Dieter McGraw-Hill Book Company 1988 入門転位論 加藤雅治 裳華房 1999		
Websites			
Website of Laboratory			
Additional Information	Students are required to have a fundamental knowledge (an average level of undergraduate students of materials science) on materials science (especially elastic theory, phase diagram and microstructure control) . If the requirements are not fulfilled, it is quite difficult to understand the lecture and obtain the credits.		