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Fakultät für Naturwissenschaften, Fachbereich Physik

Announcement

Crystal Defects: Physical Effects and Mechanics

apl. Prof. Dr. Jeong-Ha You

Learning outcomes

The students who have successfully completed the course work of this lecture will

- gain basic understanding on the types, structures, formation mechanisms and physical effects of various kinds of crystal defects,
- be equipped with theoretical skills for describing the dynamic interactions and energetic reactions between defects based on a continuum mechanics framework,
- be able to interpret various physical, thermal and mechanical features being observed in actual crystalline solids in terms of defect effects in addition to idealized bulk behaviours,
- get fundamental knowledge on the microstructures and mechanical behaviours of engineering materials.

Content

- Classification and structures of crystal defects
- Point defects: formation mechanisms, physical effects, thermodynamics, irradiation damage
- Elements of solid mechanics (linear elastic), continuum slip theory, crystal plasticity
- Line defects: edge/screw dislocation, slip mechanisms, stress/displacement/strain fields
- Dynamics of dislocations: line tension, forces between dislocations, reaction mechanisms
- Planar defects: structure of grain boundaries, impact on mechanical behaviour, interactions
- Recovery of defects, recrystallization and grain growth

Prerequisites

Introductory courses on calculus, mechanics and solid-state physics (or materials science)

Additional information

Course type: Block lecture
Without examination: 2 ECTS credits
With examination (written): 3 ECTS credits

Date

Tue, 3.3.2020, 13.00 – 18.00
Wed, 4.3.2020, 10.00 – 17.00
Thu, 5.3.2020, 10.00 – 17:00
Room: N24/226

Lecturer

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Literature

- Mechanical Behaviour of Materials, Keith Bowman, John Wiley & Sons, 2004
- Physikalische Grundlagen der Materialkunde, G. Gottstein, Springer-Lehrbuch (3 Aufl.), Springer
- Introduction to Dislocations, Hull & Bacon, Pergamon (3rd Ed.)
- Deformation and Fracture Mechanics of Engineering Materials, R. Hertzberg, John Wiley & Sons
- Theory of Dislocations, Hirth & Lothe, John Wiley & Sons
- Crystal Defects and Microstructures, R. Phillips, Cambridge University Press
- Crystallography and Crystal Defects (revised ed.), A. Kelly, G. W.Groves, P. Kidd, John Wiley & Sons
- Mechanical Metallurgy, M. Meyers, K. Chawla, Prentice Hall