PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICAL AND METALLURGICAL ENGINEERING
ABET COURSE SYLLABI

ICM 2433 PHYSICAL METALLURGY

Credits and contact hours: 10 UC credits / 10 hours (3 hours in lectures and 7 individual work hours per week)

Instructor's name: Miguel Vial Cruz

Course coordinator's name To be defined

Textbook:
- SMITH, William F. Structure and properties of engineering alloys. 2nd. ed. New York, McGraw Hill, 1993.
- Shwemon, Paul G. Transformations in metals, McGraw-Hill Series in materials Science and Engineering, 1969

Course Catalog Description: To be defined

Prerequisite Courses: ICM1202 Engineering Materials or ICM 2403 Materials Science

Co-requisite Courses: None

Status in the Curriculum: Minimum course

Course Learning Outcomes:
1. To know the factors that affects the formation of microstructures in casting.
2. To know different casting processes and the factors that influences a healthy casting.
3. To understand the following relations: termomechanical treatment - microstructures - mechanical properties in metals and alloys.
4. To specify thermo-mechanical treatments to obtain certain final properties.
5. To identify microstructures produced by welding, their mechanical properties and defects produced when welding.
6. To select alloys and their manufacturing processes for specific applications in engineering.

Relation of Course to ABET Criteria:
b. Design and conduct experiments: analyze and interpret data
c. Design a system, component, or process
d. Multidisciplinary teams
e. Identify, formulate, and solve engineering problems
f. Professional and ethical responsibility
g. Effective communication
j. Knowledge of contemporary issues

k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. Review of concepts from diffusion, and kinetics of phase transformation.
2. Solidification: nucleation and growth. Crystal growth shapes. Solute redistribution in alloy solidification. Solid liquid interface instability in alloys. Ingot solidification. Eutetectic solidification. Iron casting, Al-Si. Peritectic solidification.
3. Casting design elements. Casting analysis.
4. Recovery and recrystallization. Point defect recovery and micro structural change using low temperature annealing. Recrystallization. Nucleation, growth and engineering laws. Crystallographic textures. Hot working. Grain growth. Second phase effect in grain growth. Grain equilibrium shapes.
5. Phase transformation in solid state. Nucleation and growth in solid phases. Iron: ferritic transformation and kinetic of growth. Pearlitic transformation. Bainite. Martensite. TTT curves and continuous cooling curve. Steel hardenability. Tempering of hardened steel. Steel in tools. Thermal treatment of hardening.
6. Aluminum allots and precipitation hardening. Classification. Commercial pure aluminum. Al-Mg; Al-Cu; Al-Cu-Mg; Al-Mg-Si. Al alloys for casting.
7. Stainless steels: Phase diagrams. Ferritic stainless steel. Mastensite stainless steel. Austenitc stainless steel.
8. Copper and alloys: Extraction, commercial pure copper. Low allay copper. Copper alloys Cu-Zn; Cu-Sn, Cu-Al y Cu-Ni.
9. Welding: solidification zone metallurgic. Heat affected zone metallurgic. Properties and defects. Welding ability..
10. No destructive testing.

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