



UNIVERSIDADE FEDERAL DE SÃO CARLOS
PRÓ – REITORIA DE PÓS-GRADUAÇÃO

COURSE DESCRIPTION SHEET



1. Course Name: **Materials Science I**
2. Course Code: 001
3. Semester offered: 1st
4. Total course credits: 10
5. Course workload
 - 5.1. Lecture classes: 60h
 - 5.2. Practical classes:
 - 5.3. Seminars: 90h
6. Course Syllabus:
 - Atomic model, Schrödinger equation, chemical bonds, and band structure in solids;
 - Crystal arrangements (unit cells, crystallographic directions and planes, packing factor, grain, grain boundary, and phases). Crystal arrangements in metals, polymers, and ceramics;
 - Imperfections in crystal arrangements (point defects and solid solutions, line defects and plastic deformation);
 - Heat treatment - restoration of crystal structure, boundary defects, optical microscope. Volumetric, surface, and grain boundary diffusion (self-diffusion, interdiffusion, vacancy diffusion, interstitial diffusion), factors affecting diffusion and activation energy (Fick's Laws);
 - Phase diagrams (binary isomorphous systems, present phases, chemical composition of phases, phase fraction - lever rule, development of microstructures, non-equilibrium solidification, phase segregation);
 - Binary eutectic systems (eutectic reactions, intermediate phases, eutectoid and peritectic reactions): Gibbs Phase Rule;
 - Phase transformations (transformations with and without atomic diffusion, formation of metastable phases);
 - Reaction kinetics (atomic diffusion, nucleation, growth, crystallization, and recrystallization);
 - Mechanical properties of materials.
7. Main Bibliography:
 - P. W. Atkins, Physical Chemistry, 4th Edition, Oxford University Press, Oxford, 1992.
 - L. V. Vlack, Princípios de Ciência e Tecnologia de Materiais, Campus, 1984.

- W. D. Callister Jr. Materials Science and Engineering: an introduction, 3rd Edition, John Willey, New York, 1994
- N.W. Aschcroft, N. D. Mermin, Solid State Physics, Sounders College-HRW, Filadelfia, E.U.A, 1976.
- J. F. Shackelford, Introduction to Materials Science for Enginners, 4th, Edition, Prentice Hall, 1996.
- D. R. Askeland, The Science and Engineering of Materials, 3rd Edition, ITP, New York, 1994. 7
- C. Kittel, Introdução à Física do Estado Sólido, 5ª Edição, Guanabara-Koogan, Rio de Janeiro, 1978