



Course Syllabus

Department/Faculty School of Engineering
Graduate Program Materials Engineering and Nanotechnology
Degree <input type="checkbox"/> Academic Master's <input checked="" type="checkbox"/> Doctorate (PhD) <input type="checkbox"/> Professional Master's
Course Name Solid state thermodynamics
Professor(s) Prof. Leandro Seixas
Office hours 48
Course Overview Principles of solid state chemistry and physics. Solid state reactions. Free energy of binary and ternary systems. Equilibrium of multicomponent heterogeneous systems. Thermodynamics of defects in crystals. Applied thermodynamics and solid-state electrochemistry.
Topics outline Concepts and definitions, Function of states, Process variables, Energy, Reversible and irreversible process. Laws of thermodynamics. Thermodynamic variables and relations. Enthalpy. Entropy. Gibbs free energy. Maxwell relations. Useful thermodynamic relations. Heat capacity. Clausius-Clapeyron equation. Applications in solids and liquids. Solutions, definitions, variables for solution compositions, definitions for partial molar properties, chemical potentials, molar quantities, relations between molar properties and total properties, graphical interpretations, mixing process, ideal solutions, regular solutions. Phase diagrams, conditions for the equilibrium, eutectic phase diagram, other phase diagrams. Chemical equilibrium, gasogenous equilibrium, solid-vapor equilibrium, equilibrium constants with the temperature. Atomic diffusion, Fick's laws, mechanism of diffusion. Nucleation, nucleation in pure solids, homogeneous nucleation, solid nucleation in liquids, driving force in nucleation, nucleation ratios. Crystal interfaces and microstructures, interface free energy, solid-vapor interface, grain boundary, solid interface, elastic energy. Growth, growth of pure substances, solidifications of alloys, transformation with diffusion in solids.
Letter Grade Assignment Grade A (Excellent) - Grade points between 9 and 10 Grade B (Good) - Grade points between 8 and 8.9 Grade C (Satisfactory) - Grade points between 7 and 7.9 Grade D (Unsatisfactory) - Grade points between 0 and 6.9
Texts, Materials, and supplies DEVEREUX, O. F., Topics in Metallurgical Thermodynamics, John Wiley & Sons Inc., 1983 DE HOFF, R. T., Thermodynamics in Materials Science, Mc Graw-Hill, New York, 1993 SWALIN, R. A., Thermodynamics of Solids, John Wiley & Sons Inc. New York, 1962. HOGE, C. E., Thermodynamic Aspects of Solid State Engineering, Springer US, 1975.