



University Bulletin

Undergraduate Degree Programs

Materials Science and Engineering (MATSE)

MATSE 505 Irreversible and Statistical Thermodynamics of Materials (3) Introduction to statistical and irreversible thermodynamics as applied to chemical and materials systems.

MATSE 505 Statistical and Irreversible Thermodynamics (3)

This course will introduce students to statistical and irreversible thermodynamics as models of describing equilibrium and rate process starting from the atomic/molecular level. The course will begin with a review of relevant concepts from classical thermodynamics, including the four laws, entropy, Gibbs and Helmholtz functions, and chemical and electrochemical equilibrium. The formulation of classical thermodynamics does not require the existence of atoms, as it is largely concerned with average, bulk properties and, indeed, much of classical thermodynamics was developed before the existence of atoms, and molecules was accepted unequivocally in the scientific disciplines. However, knowledge of the properties of atoms and molecules allows one to predict the thermodynamic properties of bulk materials through the discipline of statistical thermodynamics (statistical mechanics) in an *ab initio* manner. Indeed, many tabulated thermodynamic properties, particularly for unstable systems, have been calculated rather than measured. Finally, we live in an irreversible world (i.e., one that evolves, such that the entropy of the system and surroundings continuously increases), and statistical thermodynamics cannot provide a satisfactory description of this change. Spontaneous change is best described in terms of the discipline of Irreversible Thermodynamics, which addresses the rate of generation of total entropy of the system plus surroundings. The framework of Irreversible Thermodynamics will be established in terms of coupled fluxes and Onsager's Reciprocity Principle and these concepts will be employed to explain thermal diffusion and electro-osmosis, among other phenomena.

General Education: None

Diversity: None

Bachelor of Arts: None

Effective: Spring 2007

Prerequisite: **MATSE**

[401\(/bulletins/bluebook/university_course_descriptions.cfm?letter=M&courselong=MATSE|latest\)](#), [MATSE 501\(/bulletins/bluebook/university_course_descriptions.cfm?letter=M&courselong=MATSE|latest\)](#) or instructor's permission

Note : Class size, frequency of offering, and evaluation methods will vary by location and instructor. For these details check the specific course syllabus.

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