MSE 4006: Processing and Applications of Engineering Alloys

Credit hours and contact hours: 3-0-0-3

Instructor: Arun M. Gokhale

Textbook: William F. Smith, *Structure and Properties of Engineering Alloys*, McGraw-Hill, 2nd Edition, 1993.

Specific course information

Catalog description: Solidification, deformation, and powder processing of metals and alloy; microstructural design at nano- and meso-length scales; and structure-property correlations.

Prerequisites: MSE 2021 – Materials Characterization and MSE 3002 - Structural Transformations

Course: Selected Elective

Specific goals for the course

Outcomes of instruction:

Outcome 1: The student will demonstrate understanding of how process conditions and alloy chemistry affect microstructure

Outcome 2: The student will demonstrate understanding of deformation processing of engineering alloys and how the deformation processing parameters affect microstructure and mechanical properties

Outcome 3: The student will develop understanding of isothermal and continuous cooling transformations, major heat treatments, and thermo-mechanical processing of steels

Outcome 4: The student will develop understanding of applications of different classes of steels based on their chemistry, microstructure, and processing

Outcome 5: The student will develop understanding of processing-structure-properties relationships and applications of Al-, Mg-, Ti-, and Cu- and Ni-alloys

Outcome 6: The student will develop understanding of processing-structure-properties relationships and applications of Ni-, Co-, and Fe-base superalloys

Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Topics covered:

The course will emphasize the basic elements of processing and properties of ferrous and non-ferrous metals and alloys, with a focus on process-structure-property correlations and microstructural design at nano-, micro-and meso-length scales.

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	Student Outcomes						
	1	2	3	4	5	6	7
1. The student will demonstrate understanding of how process conditions and alloy chemistry affect microstructure	X						
2. The student will demonstrate understanding of deformation processing of engineering alloys and how the deformation processing parameters affect microstructure and mechanical properties	X						
3. The student will develop understanding of isothermal and continuous cooling transformations, major heat treatments, and thermo-mechanical processing of steels	X						
4. The student will develop understanding of applications of different classes of steels based on their chemistry, microstructure, and processing	X						
5. The student will develop understanding of processing-structure-properties relationships and applications of Al-, Mg-, Ti-, and Cu- and Ni-alloys	X						
6. The student will develop understanding of processing-structure-properties relationships and applications of Ni-, Co-, and Fe-base superalloys	X						

School of Materials Science and Engineering Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.