

Course Syllabus

1. General Information:

Alpha-numeric codification: CIIM 6026
 Course Title: SOLIDIFICATION PROCESSES
 Number of credits: 3
 Contact Period: 3 hours of lecture per week

2. Course Description:

English: Study of heat and mass transfer concepts applied to solidification processes. The properties of crucibles and molds as well as the metallurgy of molten alloys and cast metal matrix composites will be studied. Computational simulation of solidification processes to analyze them from a mechanistic and practical viewpoint.

Spanish: Estudio de los conceptos de transferencia de calor y masa aplicados a procesos de solidificación. Se estudiarán las propiedades de crisoles y moldes, así como la metalurgia de las aleaciones fundidas y la fundición de compuestos de matriz metálica. Simulación computacional de procesos de solidificación para analizarlos desde un punto de vista mecanístico y práctico.

3. Pre/Co-requisites and other requirements:

Graduate student with permission of the Program Coordinator.

4. Course Objectives:

By the end of the course students will:

- Analyze microstructure development during solidification
- Apply phase equilibrium concepts in the prediction of solidification microstructures
- Analyze dendritic growth and eutectic solidification based on thermodynamic and kinetics considerations.
- Propose computational models of cast structures and alloy behavior during solidification

Evaluate the optimization of materials properties and the development of novel materials based on solidification concepts.

5. Instructional Strategies:

conference discussion computation laboratory

seminar with formal presentation seminar without formal presentation workshop

art workshop practice trip thesis special problems tutoring

research other, please specify:

6. Minimum or Required Resources Available:

No specific resources are required

7. Course time frame and thematic outline

Outline	Contact Hours
- Binary and Ternary Phase Diagrams. Multicomponent system and thermodynamics of condensed mixtures	10
- Kinetics effect on crystallization. Solute redistribution	10
- Morphological stability analysis. Microstructure evolution. Cells and dendrites. Eutectic growth	10

- Modeling methods. Numerical modeling of casting solidification	5
- Application of novel processing methods.	8
-Exams	2
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (letters) Not Quantifiable

Standard Curve:

100-90 A; 89-80 B; 79-70 C; 69-60 D; 59-0 F

9. Evaluation Strategies

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	2	50
<input checked="" type="checkbox"/> Final Exam	1	25
<input checked="" type="checkbox"/> Short Quizzes	5	15
<input type="checkbox"/> Oral Reports		
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	1	10
<input type="checkbox"/> Journals		
<input type="checkbox"/> Other, specify:		
TOTAL:		100%

10. Bibliography:

Textbook:

Stefanescu, D. M. (2009). *Science and engineering of casting solidification*. New York, N.Y: Springer. <http://dx.doi.org/10.1007/b135947> [Available via Springer eBooks, UPRM General Library]

Other resources:

ASM International. (2009). *Casting design and performance* [e-book]. Materials Park, Ohio: ASM International. [Available online via EBSCO eBooks Collection, UPRM General Library]

Cantor, B., & O'Reilly, K. (Eds.). (2003). *Solidification and casting: An Oxford-Kobe materials text*. Bristol: Institute of Physics. <http://dx.doi.org/10.1201/9781420033502> There is no newer version. [Available via MATERIALSnetBASE, UPRM General Library]

Selected articles from: *Acta Materialia*. Elsevier. (<http://www.journals.elsevier.com/acta-materialia>) [Available online via ScienceDirect, UPRM General Library]

Literature reviews available in: *Annual Review of Materials Research* [Available online via Annual Reviews, UPRM General Library]

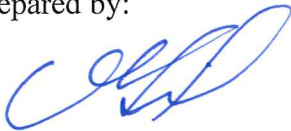
Selected articles from: *Canadian Metallurgical Quarterly*. Elsevier. (<http://www.sciencedirect.com/science/journal/00084433>) [Available online via ScienceDirect, UPRM General Library]

Selected articles from: *Metallurgical and Materials Transactions A*. Springer. (<http://www.springer.com/materials/special+types/journal/11661>) [Available online via ProQuest Central, UPRM General Library]

Selected articles from: *Metallurgical & Materials Transactions B*. Springer. (<http://www.springer.com/materials/special+types/journal/11663>) [Available online via ProQuest Central, UPRM General Library]

11. According to Law 51: Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students Office at (787) 265-3864 or (787) 832-4040 extensions 2040 or 3372.

Prepared by:



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Approved by:



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Revised: June 2016