

# Physical Ceramics I

EMA 4144 Section 1234

**Class Periods:** T 3 9:35 am and R 3-4 9:35 am – 11:15 am

**Location:** T TUR 2346 and R TUR 2336

**Academic Term:** Fall 2016

## Instructor:

Professor Juan Claudio Nino

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Office Hours: M and W, 10-11:30 am, 166 RHN

## Teaching Assistants:

- NONE

## Course Description

Crystal structure of complex ceramic compounds. Influence of structural imperfections and stoichiometry on physical characteristics, surface and interfacial phenomena, diffusion and phase transformations in ceramic systems. (3 Credit Hours)

## Course Pre-Requisites / Co-Requisites

EMA 3050 Ceramic Engineering (Introduction to Ceramics)

## Course Objectives

Through interactive multimedia lectures, at the end of the course the students are expected to be able to:

- Describe the crystal structure of common and advanced functional ceramic compounds.
- Predict the dominant point defect species in ceramics as a function of temperature and atmosphere.
- Determine and utilize structure-processing-property relationships to engineer advanced ceramics.
- Critically analyze recent ceramic materials advances and developments in literature.

## Professional Component (ABET):

This course provides 3 credits towards engineering topics.

## Relation to Program Outcomes (ABET):

The table below is an example. Actual outcomes will vary by program. Below is applicable only to MSE.

Outcome	Coverage*
a. Apply knowledge	High
b1. Conduct experiments	
b2. Statistical design of experiments	
c. Design	
d. Function on teams	Low
e. Solve problems	Medium
f. Professional and ethical responsibility	
g. Communicate	
h1. Economic impact	
h2. Global, societal, and environmental impact	
i. Lifelong learning	Low
j. Contemporary issues	Medium
k. Techniques, skills, and tools for degree program	High

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

## Required Textbooks

- Title CERAMIC MATERIALS
- Author C.B. Carter & M.G. Norton
- Publication date and edition 2013 Second Edition (Springer)
- ISBN number 978-1-4614-3522-8

Online Material: This course will use CANVAS extensively as a communication and archival tool. The students can access all relevant course information (course notes, homework and exam solutions, announcements, grades, etc.) via the CANVAS entry link: <http://elearning.ufl.edu/>.

### Course Schedule

Below is the tentative schedule of topics, activities, reading assignments, exams, and homework

Dates	Topics	Reading Assignments	Homework
<b>Aug</b>			
23, 25	Introduction, EMA3010 and EMA 3050 Review	Ch 1-5	
30	Binary Compounds	Ch 6	
<b>Sep</b>			
1	Complex Structures + Recent Literature (RL)	Ch 7	
6	Glasses	Ch 7	
8	Ceramics Phase Diagrams + RL	Ch 8	HW 1 (due 9/12)
13	Reactions Upon Heating and Cooling	Ch 8 + CANVAS	
<b>15</b>	<b>EXAM 1</b>		
20	Point Defects	Ch 11	
22	Defect Equilibria + RL	Ch 11	
27	Surfaces	Ch 13	
29	Films + RL	Ch 13	
<b>Oct</b>			
4	Grain Boundaries	Ch 14	
6	Phase Boundaries	Ch 15	
11	Mechanical Testing	Ch 16	
13	Plasticity	Ch 17	HW 2 (due 10/17)
18	Fracture	Ch 18	
<b>20</b>	<b>EXAM 2</b>		
25	Conductivity	Ch 30	
27	Insulators + RL	Ch 31	
<b>Nov</b>			
1, 3	Optical Ceramics + RL	Ch 32	HW 3 (due 11/7)
8, 10	Magnetic Ceramics + RL	Ch 33	
15, 17	Thermal Properties + RL	Ch 34	
22	BioCeramics + RL	Ch 35	HW 4 (due 11/28)
29	Energy Applications + RL	Ch 37	
<b>Dec</b>			
<b>1</b>	<b>EXAM 3</b>		
6	Course Wrap up + Recent Developments (P)		
	<b>NO FINAL EXAM</b>		

### Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is highly encouraged since significant amount of individual and collaborative work will be performed during the class sessions. Moreover, key explanations and examples that will aid in preparation for the exams will be presented in class.

Exams will be open book and in class as scheduled above. Students are allowed to bring the hardcopy of the second edition of the course textbook. Digital versions or home printed versions of the book will not be allowed

during the exam. Solution to the exam will not posted. Students can review the exam solution during office hours. **There will be no make-up exams given the advanced exam scheduling.** Exceptions will be made only due to verified personal emergency supported by written documentation. **There will be no final exam.**

Homework problems will serve as preparation for the exams and are assigned roughly every four weeks with the exercises posted on CANVAS. Homework is to be submitted online on CANVAS as a PDF file and will be due by **10 pm the following Monday**. The availability to submit homework answers online is controlled automatically. **No late homework will be accepted.** Group discussions towards homework solving and teamwork are encouraged but all answers that are turned in should be the result of your own work.

Four unannounced Quizzes will be distributed throughout the course and will occur on Thursdays. Quizzes will consist of two simple questions about the material covered on Tuesday of that week. Correctly answering one of the two questions will be sufficient to receive full credit. **Students not attending that day will receive a score of zero points in that quiz.**

Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

### **Evaluation of Grades**

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Homework Sets (3)	10 each	20%
Quizzes (4)	5 each	20%
Exam (3)	20 each	60%
		100%

### **Grading Policy**

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>	<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
93.4 - 100	A	4.00	73.4 - 76.6	C	2.00
90.0 - 93.3	A-	3.67	70.0 - 73.3	C-	1.67
86.7 - 89.9	B+	3.33	66.7 - 69.9	D+	1.33
83.4 - 86.6	B	3.00	63.4 - 66.6	D	1.00
80.0 - 83.3	B-	2.67	60.0 - 63.3	D-	0.67
76.7 - 79.9	C+	2.33	0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

### **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### **Course Evaluation**

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### **University Honesty Policy**

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### **Software Use**

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### **Student Privacy**

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### **Campus Resources:**

#### Health and Wellness

##### **U Matter, We Care:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

#### Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling.  
<https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.