

## **Physical Ceramics**

EMA 6938 Sections 2020, 2FED, 2OVR, FE22

**Class Periods:** 3 per week, 100% online, asynchronous

**Location:** CANVAS, Zoom classroom, 100% online.

**Academic Term:** Fall 2020

### ***Instructor:***

Name: Wolfgang Sigmund

Email Address: sigmund@ufl.edu

Office Phone Number: 352-846-3343

Office Hours: Wednesdays from 10 am to noon via zoom, more appointments available via email request.

### ***Teaching Assistant/Peer Mentor/Supervised Teaching Student:***

Please contact through the CANVAS website

### ***Course Description***

This course covers the basic knowledge for creating complex ceramic and inorganic glass materials. It connects thermodynamics, phase diagrams, and their use in processing to achieve specific properties. Focus will be given to crystal structure, stoichiometry, structural imperfections, grain boundaries. Furthermore, it teaches how processing is defined by the above given physics and chemistry. The impact of crystal structure and processing on fundamental physical characteristics, such as surface, and interfacial phenomena, diffusion, and phase transformations in ceramic systems are also discussed. (3 credit hours)

### ***Course Pre-Requisites / Co-Requisites***

Pre-requisite: EMA 3010, EMA 6001, or instructor's approval.

### ***Course Objectives***

In this course the student is introduced to modern ceramic materials, their structure, properties, applications, potential uses and limitations. The specific objectives are to:

- Appreciate the factors that render ceramics unique and different from other materials
- Comprehend the bonding/property relationships in ceramics
- Understand the fundamental role of point defects and stoichiometry on the electric, dielectric, and diffusional properties of ceramics
- Understand how processing and kinetics can be used to control defects beyond thermodynamic limits
- Gain knowledge of optical, magnetic and dielectric properties of ceramics
- Discover the critical role of flaws, surfaces and interfaces on mechanical properties
- Understand the impact processing has on flaws and mechanical properties

### ***Materials and Supply Fees***

None

### ***Required Textbooks and Software***

- a. Title: Ceramic Materials: Science and Engineering
- b. Authors: C. Barry Carter and M. Grant Norton
- c. Publisher: Springer
- d. Second edition
- e. ISBN number: **9781461435228**

### ***Course Schedule as Guidance.***

Week 1:	Introduction and Refresher on Background needed for this class / Chapters 1, 2, 3.
Week 2:	Bonds and Energy Bands; Models, Crystals, Chemistry / Chapters 4, 5/Term papers start.
Week 3:	Models, Crystals, and Chemistry; Binary Compounds; Publishing /Chapters 5, 6, 7.
Week 4:	Complex Crystal and Glass Structures Topic / Chapter 7.
Week 5:	Equilibrium Phase Diagrams; Furnaces; Characterizing Structure / Chapters 8, 9, 10.
Week 6:	Point Defects, Charge, and Diffusion; Review lecture/ Chapter 11/ Oral Zoom Exam.
Week 7:	Dislocations; Surfaces, Nanoparticles / Chapters 12, 13/Term paper 1 due.
Week 8:	Interfaces in Polycrystals; Phase Boundaries / Chapters 14, 15.
Week 9:	Mechanical Properties / Chapters 16, 17, 18.
Week 10:	Processing / Chapters 19, 20.
Week 11:	Processing / Chapters 22, 23.
Week 12:	Sintering and Grain Growth / Chapters 24, 25, 26/Term paper 2 due.
Week 13:	Conducting Charge; Redistributing Charge; Review / Chapters 30, 31 / Oral Zoom Exam.
Week 14:	Interacting with Light / Chapter 32.
Week 15:	Capstone: connecting thermodynamics, kinetics, with microstructure and properties / Chapters 1-32; additional material by Dr. Sigmund

### ***Online Course Recording***

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

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

The class is 100% online. You can take the modules and listen to the lectures at any time. There is no attendance required other than the oral exam appointment. A computer, laptop and internet access is required to be able to access the class and submit your work. There is no graded homework and there are no graded quizzes. If an oral exam appointment that the instructor and the student agreed upon is missed without prior notice by the student, it counts as 0 points towards the grade. If the deadline for the term paper submission is missed, without prior notice to the instructor, it counts as 0 points towards the grade. If a student gives advanced notice an extension can be granted if it falls under the university policies given below. For computer/internet problems a UFIT trouble ticket is required with a time stamp before the deadline or meeting. Excused absences must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Midterm Oral Exam	100	25%
Last Oral Exam	100	25%
Term Papers	100	50%
	<b>Total</b>	<b>100%</b>

## ***Grading Policy***

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
92.0 - 100.0	A	4.00
88.0 - 91.9	A-	3.67
84.0 - 87.9	B+	3.33
80.0 - 83.9	B	3.00
76.0 - 79.9	B-	2.67
72.0 - 75.9	C+	2.33
68.0 - 71.9	C	2.00
65.0 - 67.9	C-	1.67
62.0 - 64.9	D+	1.33
59.0 - 61.9	D	1.00
56.0 - 58.9	D-	0.67
0 - 55.9	E	0.00

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

## ***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

## ***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

## ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***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: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### ***Health and Wellness***

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

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**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 Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **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. <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://care.dso.ufl.edu>.

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