

Physical Ceramics 1
EMA 4144 Section 4144(25577)
Class Periods: Asynchronous on CANVAS
Location: Online/CANVAS
Academic Term: Fall 2020

Instructor:

Prof. Wolfgang Sigmund

Email: sigmund@ufl.edu

Office Phone Number: 352-846-3343

Office Hours: Wednesday from 10 am to noon via Zoom, additional appointments may be arranged via email.

Teaching Assistants:

Please contact through the CANVAS website

Course Description

This course covers the structure of complex ceramic compounds and glasses. The influence of structural imperfections and stoichiometry on physical characteristics, surface, and interfacial phenomena, diffusion, and phase transformations in ceramic systems are also discussed. (3 credit hours)

Course Pre-Requisites / Co-Requisites

The prerequisite for the course is EMA 3050: Introduction to Inorganic Materials.

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
- Gain knowledge of optical, magnetic and dielectric properties of ceramics
- Discover the critical role of flaws, surfaces and interfaces on mechanical properties

Materials and Supply Fees

None

Professional Component (ABET):

3 credits Engineering Topics

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of 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	Low
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.	

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

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

Course Schedule as guidance. The course is asynchronous, i.e. students can work at their own pace.

Week 1:	Introduction and Refresher on Background needed for this class / Chapters 1, 2, 3.
Week 2:	Bonds and Energy Bands; Models, Crystals, and Chemistry / Chapters 4, 5/ Term paper 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/ Chapter 11/ Oral Exam on Zoom
Week 7:	Dislocations; Surfaces, Nanoparticles / Chapters 12, 13
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 papers due
Week 13:	Conducting Charge; Redistributing Charge; Review / Chapters 30, 31 / Oral Exam Zoom
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 only practice homework and no graded homework and there are no graded quizzes. Reflection papers are due for specific chapters. 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

Assignment	Total Points	Percentage of Final Grade
Homework Sets (5)	0 each	0%
Reflection sets (5)	100 each	20%
Midterm Oral Exam	100	30%
Last Oral Exam	100	30%
Term Paper	100	20%
		100%

Grading Policy

Percent	Grade	Grade Points
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:

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

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.blueram.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
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, 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 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

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>.