

1. EMA4041L Ceramic Processing Lab 1
2. 1 Credit Class/laboratory schedule: laboratory once a week for two hours.
3. Nancy Ruzycki
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Office Hours TDB
4. Class Times – Class meets Tuesday 6 & 7th period – 12:50 – 1:55 PM. Rhines B06
5. Recommended Reading:
Title – Ceramic Processing, by M.N. Rahaman, CRC, Taylor and Francis, 2007. ISBN 0-8493-7285-2
Title - CERAMIC MATERIALS by C.B. Carter & M.G. Norton, 2013 Second Edition (Springer), ISBN number 978-1-4614-3522-8
6. Specific course information
 - a. At the end of this course students will be able to understand and apply the basic principles of ceramic processing, including characterization techniques, colloid and surface science, sol-gel techniques, particle mechanics, ceramic forming and sintering.
 - b. Pre-requisite EMA 3050
 - c. This is an elective course
7. Specific goals for the course
 - a. This course addresses the following MSE Program outcomes (note: Numbers refer to the list of MSE Program outcomes):
 1. Apply knowledge of mathematics, science and engineering principles to materials science and engineering.
 2. Design and conduct materials science and engineering experiments and analyze and interpret the data.
 3. Design a materials science and engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints.
 4. Communicate technical data and design information effectively in speech and in writing to other materials engineers.

ABET

- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

- (d) an ability to function on multidisciplinary team
 (g) an ability to communicate effectively

8. Brief list of topics to be covered. Students will complete two required, and two optional processing units in this course. Each lab will require a complete Hazard Assessment, SOPs and process steps to be written, Technical reports, and a final report for the class.

Module	Topic	Content/Outcomes
Safety	Hazards Assessment	Hazards assessment, SOPs, experimental outlines
Glass Processing	Borate Glasses Alkali Borate Glass Bioglass	Glass structure Glass melts Glass pouring Glass quenching Raman/FTIR XRD
Sol Gel	LNO TiO ₂ BioGlass BaTiO ₃	Sol-Gel basics Sol-gel processing Controlling structure during sol-gel Controlling particle size during sol-gel SEM XRD FTIR
Solid State Sintering and Microstructure	BaTiO ₃ MgTiO ₃ -CaTiO ₃ BiFeO ₃	Basics of Solid State Sintering Process of pressing and green pellets Controlling grain size and porosity during sintering SEM XRD FTIR
Solution Processing	LNO Soft Solution Processing	Basics of solution processing Novel method of soft solution processing Spin Coating RTA XRD SEM FTIR
Co-precipitation	BaTiO ₃ Fe ₃ O ₄	Basics of Co-Precipitation Methods of co-precipitation Controlling for particle size XRD SEM FTIR

Advanced ceramic processing	Electrospinning 3D printing Ceramic Foams <u>Quantum Dots</u>	Basics of Electrospinning 3D printing and ceramics Ceramic Foams and structures XRD SEM FTIR
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9. Attendance and Expectations - Attendance is **strongly** suggested since significant amount of participative as well as individual and collaborative work will be performed during the class sessions and labs are not made up in this course. **Students are expected to comply with all laboratory guidelines, protocols, and procedures. Students who do not comply with these requirements or who behave disorderly or disrespectfully WILL be asked to leave. Leaving your cell phone on, leaving early or arriving late can be VERY distracting, you should avoid it. All electronic devices (laptops, cell-phones, etc.) should be turned off or in silent mode.** Students may not bring phones or devices into the clean room lab areas, unless they are in their pockets. Phones may not be touched while wearing gloves, students must leave the room and remove gloves before touching phones.

10. Students will be graded according to the following:

Student daily notebook	30 % of final grade
Hazards Assessments	15 % of final grade
SOPs and Processing Steps	15 % of final grade
Techniques and skills utilized in processing	15 % of final grade
Technical and Final Reports	25 % of final grade

11. Grading Scale - Grades will not be curved and there is no extra credit.

Grade	Earned percentiles total
A	93
A-	88
B+	84
B	80
B-	76
C+	72
C	68
C-	65
D+	62
D	59

D-	56
E	50

12. This statement must be included in every grade scale for undergraduate level 1000-5000 syllabi:

“A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C-average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:

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

13. There are no exams in this course. Make-up Work Policy – Make up work will be provided only with the **prior approval of the instructor in accordance with university policies**. In general, acceptable reasons for excused absence include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal obligations, and religious holidays. In all cases you will be required to provide written documentation, and obtain prior instructor approval. You will not be excused from any work without following the policy above, with no exceptions. Students not in attendance for the scheduled work will receive a score of zero. To be clear, Make-up work will only be allowed in exceptional cases, with prior instructor approval, sufficient documentation, and in accordance of university policies. Make-up work for excused absences as well as work conflicts must occur within 1 week of the missed work, and may occur before the missed work.

14. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

15. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

16. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.

Career Resource Center, Reitz Union, 392-1601, career and job search services.

17. Software Use – All faculty, staff and student 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.

18. Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. 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>.

19. Diversity and Inclusion: This course supports diversity and inclusion for all students. Effective engineering practice relies on the ability to recognize and embrace diversity in all its forms, including viewpoints.