21:160:590 Special Topics in Materials Chemistry
Tuesday, 6:00 - 9:00 PM, Smith Hall Rm 240

Please note that, if necessary, the syllabus may be modified at any point during the semester.

Part 1: Templated Materials Science on the Nano and Microscale

Instructor: Prof. Tomokazu Iyoda
E-mail: tiyoda@mail.doshisha.ac.jp
Office hours: by appointment via email

Course description: We will introduce a few topics of templated materials science, in which unique shapes of nano/micro-structures found in nature are not only used as an inspiration but physically transferred onto various kinds of laboratory-made materials with their specific functions. By defining the molecular structures of substances, we can determine their properties. However, in the nano/microscale. New properties may emerge that challenge our common knowledge. For example, semiconductor nanoparticles may emit different colors of light depending on their size, known as the quantum size effect. More widely, by specializing the size and shapes of substances, we can design new materials with valuable functions. If we make use of the complex, intriguing shapes created by nature, the materials around us will also show new, valuable properties. Through ingenuity, careful observation, and freewheeling imagination, we can develop a new type of materials science that makes creative use of the diverse morphologies.

Course learning goals:
- Develop an understanding of the field of templated materials science and the techniques commonly used in this area of research.
- Design a research project aimed at developing a unique functional material based on a (selected by you) nano or micro-structure occurring in nature.

Part 1 Grading (100 points max):
Quizzes: 30%
Final section report: 70% , Due: 11/20/23

Course Schedule – Part 1

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Course objectives and introduction to templated materials science</td>
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<tr>
<td>2</td>
<td>Metal microcoils from helical algae toward 6G electromagnetic wave absorber</td>
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<td>3</td>
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<td>4</td>
<td></td>
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<td>5</td>
<td>Self-assembled nanocylinder arrays and their nano-template processes</td>
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<tr>
<td>6</td>
<td></td>
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<tr>
<td>7</td>
<td>Summary and preparation for term report</td>
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Instructor: Prof. Georgiy Akopov
E-mail: georgiy.akopov@rutgers.edu
Office hours: by appointment via email

Course description and learning goals: We will introduce a variety of solid-state chemistry methods of bulk materials synthesis, crystal growth, properties (chemical, optical, transport, and magnetic), characterization (single and powder XRD, TGA, DSC) and applications. Emphasis will be placed on the crystal structure-property relationship in materials, and as such bonding and crystal defects will be explored. The goal of this course is to familiarize students with modern methods and techniques used in materials science as they pertain to solid-state materials with everyday uses and applications.

Recommended book:

Part 2 Grading (100 points max): 6 Quizzes/Homeworks: 6 x 10% = 60%
Final section exam: 40%

Course Schedule – Part 2

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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<tbody>
<tr>
<td>8</td>
<td>Materials Synthesis</td>
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<tr>
<td>9</td>
<td>Crystal Growth</td>
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<tr>
<td>10</td>
<td>Crystal Structures, Bonding and Crystal Defects</td>
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<tr>
<td>11</td>
<td>Characterization: a) XRD; b) Thermal methods</td>
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<tr>
<td>12</td>
<td>Band Theory</td>
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<td>13</td>
<td>Electrical Properties</td>
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<tr>
<td>14</td>
<td>Magnetic and Optical Properties or Final Exam</td>
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</tbody>
</table>

Final Course Grade will be based on the total points acquired in both Parts 1 and 2 of the course (200 points course maximum).

Academic Calendar: https://myrun.newark.rutgers.edu/f23

Final Exam Schedule: https://scheduling.newark.rutgers.edu/ru-n-final-exam-schedule-fall-2022/

Academic Integrity
As an academic community dedicated to the creation, dissemination, and application of knowledge, Rutgers University is committed to fostering an intellectual and ethical
environment based on the principles of academic integrity. Academic integrity is essential to the success of the University’s educational and research missions, and violations of academic integrity constitute serious offenses against the entire academic community. The entire Academic Integrity Policy can be found here:
https://academicintegrity.rutgers.edu/sites/default/files/pdfs/current.pdf

Your health and well-being matter, and Rutgers has put in place a number of resources that are intended to help students through the challenges that might emerge during these times. Information on many of these resources appears below. Please let us know immediately if you are experiencing circumstances that are negatively impacting your academic performance. We also strongly encourage you to contact your academic advisor.

**Accommodation and Support**
Rutgers University Newark (RU-N) is committed to the creation of an inclusive and safe learning environment for all students. RU-N has identified the following resources to further the mission of access and support:

- **Absences:** All students are responsible for timely notification of their instructor regarding any expected absences. The Division of Student Affairs can provide assistance for absences related to religious observance, emergency or unavoidable conflict (illness, personal or family emergency, etc.) Students should refer to the University’s Course Attendance policy (10.2.7) at https://policies.rutgers.edu/sites/default/files/10.2.7%20-%20current.pdf, for complete expectations and responsibilities. The office can be contacted at: (973) 353-5063 or deanofstudents@newark.rutgers.edu.

- **Disabilities:** The Office of Disability Services (ODS) is responsible for the determination of appropriate accommodations for students who encounter barriers due to disability. Once a student has completed the ODS process (registration, initial appointment, and submitted documentation) and reasonable accommodations are determined to be necessary and appropriate, a Letter of Accommodation (LOA) will be provided. The LOA must be given to each course instructor by the student and follow up with a discussion. This should be completed as early in the semester as possible as accommodations are not retroactive. More information can be found at ods.rutgers.edu. Contact ODS: (973) 353-5375 or ods@newark.rutgers.edu.

- **Temporary Conditions/Injuries:** The Division of Student Affairs can assist students who are experiencing a temporary condition of injury (broken or sprained limbs, concussions, or recovery from surgery). Students experiencing a temporary condition or injury should submit a request for assistance at: https://temporaryconditions.rutgers.edu.

- **Pregnancy:** The Office of Title IX and ADA Compliance is available to assist students with any concerns or potential accommodations related to pregnancy. Students may contact the office at (973) 353-1906 or TitleIX@newark.rutgers.edu.

- **Gender or Sex-Based Discrimination or Harassment:** The Office of Title IX and ADA Compliance can assist students experiencing any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking. Students can report an incident to the office at: (973) 353-1906 or TitleIX@newark.rutgers.edu. Incidents may also be reported by using the following link: tinyurl.com/RUNReportingForm. For more information, students should refer to the University’s Student Policy Prohibiting Sexual Harassment, Sexual Violence, Relationship
Violence, Stalking and Related Misconduct located at: https://uec.rutgers.edu/policies/title-ix/.

· Interpersonal Violence: The Office for Violence Prevention and Victim Assistance can provide any student with confidential support. The office is a confidential resource and does not have a reporting obligation to report information to the University’s Title IX Coordinator. Students can contact the office at: (973) 353-1918 or run.vpva@rutgers.edu. There is also a confidential, text-based line students can text for support: (973) 339-0734.

· Crisis and Concerns: The Campus Awareness Response and Education (CARE) Team works with students in crisis to develop a support plan to address personal situations that might impact academic performance. Students may contact the CARE Team at: http://tinyurl.com/RUNCARE or careteam@rutgers.edu.

· Stress, Worry, or Concerns about Well-Being: The Counseling Center https://studentaffairs.newark.rutgers.edu/health-wellness/counseling-center has confidential therapists available to support students. To schedule an appointment: counseling@newark.rutgers.edu or (973) 353-5805. If a student is not quite ready to make an appointment with a therapist but is interested in self-help, check out https://studentaffairs.newark.rutgers.edu/health-wellness/counseling-center/sanvello-app.

· Emergencies: Call 911 or contact Rutgers University Police Department (RUPD) at (973) 353-5111.

Learning Resources:
· Rutgers Learning Center (tutoring services)
  (973) 353-5608
  https://sasn.rutgers.edu/student-support/tutoring-academic-support/learning-center

· Writing Center (tutoring and writing workshops)
  (973) 353-5847
  nwc@rutgers.edu
  https://sasn.rutgers.edu/student-support/tutoring-academic-support/writing-center