



## Improving Science and Social Literacy

The Impact of Materials on Society *subcommittee* partnered with faculty from engineering, liberal arts and sciences, and education at the University of Florida to develop an introductory level undergraduate course.

This project changes the conversation about the separation of the humanities and science fields through the creation of a collaborative, interdisciplinary, project-based course that examines the impact of materials on society throughout human civilization and into the future. In particular, this project reveals how different professions and disciplines are connected in the discovery, invention and application of materials innovations.

In addition, the Impact of Materials on Society course could be used to introduce materials science and engineering as a potential career path for community college and undecided/undeclared undergraduate students. The course has built in flexibility to be adapted to a variety of academic purposes including informal science education and community programs.

**"This course demonstrates that engineering is a social profession as well as a technical one."**

If you would like to learn more about the Impact of Materials on Society course, the modular lessons, developing additional materials lessons, or learn how to pilot the course on your campus, visit [www.mrs.org/impact-of-materials-on-society-subcommittee-goals](http://www.mrs.org/impact-of-materials-on-society-subcommittee-goals) or contact:

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### Goals of this team-taught course are:

1. To enable materials science and engineering students to obtain "the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context."
2. To change the "difficult" perception of materials science and engineering by exposing students in any major to the role, values and importance of engineering.
3. To give students in any major competence in basic materials science and engineering principles.

The Impact of Materials on Society course provides a model to build broader bridges between research in engineering, the humanities and social sciences to be able to create successful technologies that address critical social issues in ways that respect human values and belief systems.

This course examines the adoption of a wide range of materials in different societies historically and around the globe, and discusses the intended and unintended consequences of the relationships humans make with their material surroundings.

Currently, the University of Florida faculty and Materials Research Society® volunteers are participating in course evaluations and a pilot implementation program to develop final versions of the instructional materials and assessments, finalize the video lessons, and develop supporting materials and a training workshop for faculty to facilitate the dissemination of the course to other campuses in the fall of 2016.

## Meet Our Collaborators

### Materials Research Society Subcommittee

Chair - Kevin S. Jones (University of Florida)  
Sophia Acord (University of Florida)  
Jihua Chen (Oak Ridge National Laboratory)  
Blythe G. Clark (Sandia National Laboratory)  
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Wook Jun Nam (Pennsylvania State University)  
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Andrew Shreve (University of New Mexico)  
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### University of Florida Faculty

Sean Adams (History)  
Sophia Acord (Sociology)  
Marsha Bryant (English)  
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Susan D. Gillespie (Anthropology/Archeology)  
Ken Sassaman (Anthropology)

### MRS Contributing Scientists

Jenny Andrews (University of Florida)  
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Michael Hickner (Penn State University)  
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Alan Taub (University of Michigan)  
Yihong Wu (Nat'l. University of Singapore)  
Jiangeng Xue (University of Florida)

The University of Florida faculty developed weekly instructional materials and assessments. Their humanities perspectives provide the groundwork for helping students to see how the attachments that humans make to materials influence the trajectory of social change. Lessons include basic principles of materials classes and properties-structure-processing paradigms of different materials. In studying case studies from the past, students learn key lessons and principles to apply when thinking about the future social impacts of new materials and how engineers play important roles in changing or maintaining the structure and fabric of society.

Each weekly unit has an accompanying video lesson that introduces the science behind cutting edge materials innovations and imagines their future social impacts. The videos were authored by the MRS Impact of Materials on Society subcommittee, University of Florida faculty and world leading science authorities from around the globe specifically for this course.

## Weekly Societal Case Studies

### 1. The Entanglement of Earth: The Age of Clay versus the Age of Rare Earths

Rare earths are clustered together and not easy to separate. But, when you think about it, it is always difficult to separate things from each other, and humans from things. Understanding our interdependencies with materials (and their interdependencies with each other) is crucial to understanding the impact of rare earths on society.

► **Video Lesson: Rare Earth Materials**

### 2. Molding Clay, Breaking Glass, and the Past Futures of Ceramics

Matter/materials come bundled with many properties, but we only seek to use some of these at particular instances in history. The creation of new production processes suggests which properties of materials we can take advantage of in a certain time and place.

► **Video Lesson: Ceramics**

### 3. Concrete: Engineering Society through Social Spaces

Building materials affect the nature of social organization and the types of community-building opportunities that we create in our society. And the kinds of social interactions we wish to create suggest how we might create applications for new building materials.

► **Video Lesson: Building Materials: Concrete and Smart Materials**

### 4. Copper and Bronze: Trading Material Resources and Knowledge

Copper's applications involve intensive sourcing and production processes. Where are we going to get the supply to make all of these materials? How do our uses for copper require creating trade routes, public policies, anti-theft considerations, etc.?

► **Video Lesson: Copper and Photovoltaics**

### 5. Steel and Magnesium: Technology, Markets, and Creative Destruction

Where are magnesium alloys being made, and how does the production process of these alloys bring together particular groups of people in industries? How might the move to new magnesium alloys from past materials of steel require re-ordering social systems to produce and distribute these goods?

► **Video Lesson: Magnesium Alloys**

### 6. Aluminum, Amorphous Metals and the Structuring of Markets

Just like aluminum in an early century, amorphous metals have emerged as a new class of metals looking for potential applications. In addition, there are significant sustainability concerns around the necessity of alloying amorphous metals; how can we envision new applications of these materials that involve also imagining a sustainable alloying process?

► **Video Lesson: Amorphous Metals**

### 7. Writing Materials: The Politics and Preservation of Knowledge

The ways that we store and distribute information are not neutral, but are loaded with political consequences. If we think about the information storage materials of the future, what are our needs for storing and disseminating information, and what material would you use to send a message to the future?

► **Video Lesson: Magnetic Materials for Information Technology**

### 8. Gold, Silver, and the Creation of Value

We give value to materials in all kinds of socially-informed ways. How might we give new forms of value to precious metals that change how we think about their utility and value in our society? (And how have new processing techniques altered how we understand the most valuable properties of these materials?)

► **Video Lesson: Gold**

### 9. Earl Tupper, Brownie Wise and Materials Marketing (Tupperware)

An invented laboratory-based material, polymers enable us to do all kinds of neat things we can't do with naturally-occurring materials such as clay and gold. But how has our perception of polymers changed as we address new issues of sustainability? And how can we generate consumer interest in bringing these man-made materials into our everyday lives?

► **Video Lesson: Polymers**

### 10. Semiconductors and Cyborgs: Human-Material Relations in the Networked Society

Semiconductors have forever changed human-human and human-material interactions because they are the foundation of the computing revolution. As semiconducting materials become more invisibly embedded in our everyday lives, and even in our own persons, how do we ensure that they serve us, versus us serving them?

► **Video Lesson: 2-D Materials, Transition Metal Dichalcogenides and Graphene**