MSE-341

# Sustainability and materials

Abitbol Tiffany

| Cursus | Sem. | Type |
|---|---|---|
| Electrical and Electronical Engineering | MA2, MA4 | Opt. |
| Ing.-chim. | MA2, MA4 | Opt. |
| Materials Science and Engineering | BA6 | Obl. |
| Neuro-X | MA2, MA4 | Opt. |

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|---|---|
| Language of teaching | English |
| Credits | 3 |
| Session | Summer |
| Semester | Spring |
| Exam | During the semester |
| Workload | 90h |
| Weeks | 14 |
| **Hours** | **3 weekly** |
| Courses | 2 weekly |
| Exercises | 1 weekly |
| **Number of positions** | |

## Summary

This course addresses sustainability across the materials life cycle, from extraction to end of life. Students learn the concepts, metrics, and tools to evaluate the environmental and societal impacts of materials, then apply them to real-world cases.

## Content

**Overview of sustainability concepts**

- Relevant terminology, such as materials life cycle, linear vs. circular economy, UN sustainable development goals, green chemistry, end-of-life scenarios
- Metrics and tools to assess sustainability, such as material intensity, carbon footprint/handprint, life cycle assessment

**Case studies**

- Identifying environmental impacts across material lifecycles, from raw material extraction, processing, manufacture, transport, use, to end of life
- Learning via case studies, such as packaging, plastics, batteries, textiles, engineered foods, metals, ceramics, rare earth materials, scarce materials, conflict materials

**Challenges and opportunities**

- Biorefinery
- Recycling and biodegradability
- Materials from renewable resources
- Local value chains/sustainable business models (e.g., materials as a service)
- Socio-political contexts of materials

**Guest lectures**

- Guest lecture from industry on sustainability drivers and strategies
- Guest lecture offering a perspective from different academic disciplines

## Keywords

sustainability, circular economy, life cycle assessment, materials selection, green chemistry, recycling, end-of-life, renewable materials, environmental impact, sustainable materials

## Learning Prerequisites

### Required courses

No formal prerequisites. A basic background in materials science or chemistry is helpful but not required. The course is designed to be accessible to students across materials, engineering, and related disciplines.

## Learning Outcomes

By the end of the course, the student must be able to:

- Define the concepts and terminology that underpin material circularity and sustainability
- Describe the main environmental impacts across different materials classes and key products
- Identify the principal challenges and opportunities in sustainable materials development
- Analyze case studies spanning different materials classes
- Assess / Evaluate potential solutions for improving the sustainability profile of a material or product
- Formulate strategies to improve material circularity
- Design sustainability into materials, process development, and products

## Teaching methods

Lectures and exercises, with videos posted online.

## Assessment methods

Assessment based on an in-class exam and a group presentation.

## Supervision

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|---|---|
| Office hours | Yes |
| Assistant.e.s | Yes |
| Forum | No |

## Resources

### Virtual desktop infrastructure (VDI)

No

### Moodle Link

- https://go.epfl.ch/MSE-341