

MSE-433

**Towards sustainable materials**

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| Cursus                                  | Sem.     | Type |
|-----------------------------------------|----------|------|
| Environmental Sciences and Engineering  | MA2, MA4 | Opt. |
| Materials Science and Engineering       | MA2, MA4 | Opt. |
| Minor in Engineering for sustainability | E        | Opt. |

|                            |                     |
|----------------------------|---------------------|
| Language of teaching       | English             |
| Credits                    | 4                   |
| Session                    | Summer              |
| Semester                   | Spring              |
| Exam                       | During the semester |
| Workload                   | 120h                |
| Weeks                      | 14                  |
| <b>Hours</b>               | <b>4 weekly</b>     |
| Lecture                    | 3 weekly            |
| Exercises                  | 1 weekly            |
| <b>Number of positions</b> |                     |

**Summary**

This course will address and model key sustainability issues through an engineering lens. It will examine emerging materials, hard to abate, and critical materials used to manufacture items in our economy during the transition to NetZero targets and their environmental, societal, and human impacts.

**Content**

Sustainability through a materials engineering lens  
 Addressing the impacts of materials  
 Life cycle analysis  
 Monetary and mass flows  
 Hard to abate materials  
 Critical materials  
 Emerging material solutions  
 Industrial and academic guest lectures  
 Best practise case studies

**Keywords**

Sustainability, de-carbonization, NetZero strategies, emerging materials, hard-to-abate, critical materials, life-cycle-analysis, life-cycle-costing, class debates, group case studies

**Learning Prerequisites****Required courses**

None

**Recommended courses**

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**Important concepts to start the course**

Sustainability  
 Materials science and engineering  
 Role of materials engineering at the forefront of resource management  
 Interplay between materials the environment, the economy, and society / human health

**Learning Outcomes**

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

- Critique key sustainability concepts
- Analyze environmental and societal impacts
- Model impacts using LCA tools
- Assess / Evaluate the role of hard-to-abate and critical materials in the NetZero transition
- Produce sustainability initiatives in a case study
- Argue the environmental, societal, and human implications of materials utilization

### Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Communicate effectively, being understood, including across different languages and cultures.
- Give feedback (critique) in an appropriate fashion.
- Take account of the social and human dimensions of the engineering profession.
- Take responsibility for environmental impacts of her/ his actions and decisions.
- Demonstrate the capacity for critical thinking
- Make an oral presentation.
- Write a scientific or technical report.
- Access and evaluate appropriate sources of information.

### Teaching methods

Ex cathedra and invited speakers  
Group sessions with exercises and debates  
Group project and presentation

### Expected student activities

Group sessions with exercises and debates  
Short presentations in-class by students  
Group project case study research and use of modelling tools  
Group project report and presentation

### Assessment methods

50% group project written report  
20% group project presentation  
10% debate short presentation  
20% open book exam

### Resources

#### Moodle Link

- <https://go.epfl.ch/MSE-433>