

MSE-662

**Laser Materials Processing**

Hoffmann Patrik Willi, Leinenbach Christian, Wasmer Kilian Thomas

| Cursus                            | Sem. | Type |
|-----------------------------------|------|------|
| Advanced Manufacturing            |      | Obl. |
| Materials Science and Engineering |      | Obl. |

|                            |           |
|----------------------------|-----------|
| Language of teaching       | English   |
| Credits                    | 2         |
| Session                    |           |
| Exam                       | Oral      |
| Workload                   | 60h       |
| <b>Hours</b>               | <b>28</b> |
| Courses                    | 20        |
| TP                         | 8         |
| <b>Number of positions</b> |           |

**Remark**

Next time: 2019-2020

**Summary**

Provide understanding of the optical properties of materials, principles of laser operation and properties of generated light. Comprehension of basics of interaction between laser light and materials will allow analysis of the physics and chemistry of laser processes.

**Content**

- 1) Principles of laser operation, types of lasers
- 2) Properties of the laser light: light controlled in time and space
- 3) Optical properties of the materials and their physical origin at atomic level
- 4) Fundamentals of light-matter interaction: linear/non-linear absorption, refractive index, influence of light properties such as wavelength or pulse length on the process
- 5) Laser light delivery: imaging, focusing, high resolution patterns – beam quality, resolution limits
- 6) Principles of laser processing: efficiency, importance of understanding heat flow, serial processing, parallel processing, ...
- 7) Applications of laser processing: bending, welding, 3-D printing, multi-photon-processing, drilling, cutting, ablation, ...

**Note**

The course supplies all the needed basics for in-depth understanding of light materials interaction and the induced phenomena resulting in materials transformation. Therefore all existing and coming laser processes can be understood.

**Keywords**

beam quality, wavelength dependent absorption, multiphoton processes, heat flow, laser bending, key-hole welding, laser cutting, drilling, trepanning, ultrashort-pulse processing, cold ablation, 2-photon polymerization, resolution limits

**Assessment methods**

Oral and oral presentation

**Resources****Bibliography**

D. Bäuerle, Laser processing and chemistry, Springer

**Ressources en bibliothèque**

- [Laser processing and chemistry / Bäuerle](#)