High-power laser interactions with structured materials and applications

Mattia Cipriani

ENEA, Fusion and Technologies for Nuclear Safety Department, via E. Fermi 45, Frascati, Italy
mattia.cipriani@enea.it

The study of the interaction of high-power lasers with structured materials is at present a very active field of research, with a rich physics and a wide range of applications. The use of nano-structured materials in experiments with ultrashort laser pulses, with a time duration in the femtosecond range, allowed to enhance the number of accelerated particles and their energy compared to more usual materials, such as metallic foils [1–3]. On the other hand, the interaction of high-power laser pulses in the nanosecond range with micro-structured materials is being studied for its applications to inertial confinement, for their ability to smooth the beam profile, reduce the parametric and hydrodynamic instabilities and increase laser absorption [4–6]. Finally, the use of micro-structured materials with a combination of nanosecond and picosecond laser pulses allowed to enhance the acceleration efficiency of electrons and ions [7]. The broad interest in these topics recently led to the creation of a dedicated Expert Group by Laserlab-Europe AISBL.
In this talk I will give an overview over recent achievements in the study of the physics of the interaction of high-power laser pulses from the femtosecond to the nanosecond regime with nano- and micro-structured materials highlighting their peculiar features. I will then describe the recent activity of the group of the ABC facility at the ENEA Research Center in Frascati on the interaction of high-power nanosecond lasers with micro-structured materials of low-Z elements.

References

1. Prencipe I et al. *New J Phys* **23** 093015 (2021).
2. Mangione A et al. *J Inst* **16** P07008 (2021).
3. Vallières S et al. *Sci Rep* **11** 2226 (2021).
4. Cipriani M et al. *High Pow Laser Sci Eng* **9** e40 (2021).
5. Tikhonchuk V et al. *Matter and Radiation at Extremes* **4** 045402 (2019).
6. Nicolaï Ph et al. *Physics of Plasmas* **19** 113105 (2012).
7. Rosmej ON et al. *Plasma Phys Control Fusion* **62** 115024 (2020).