ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

ADVANCED MANUFACTURING AND PROCESSING

Manufacturing in EU represents approximately 21% GDP, providing more than 30 million jobs in 230 000 enterprises, mostly SMEs. Despite growing globalisation and challenges from low-wage economies, manufacturing has a bright future in Europe in a sustainable, knowledge-based society. This perspective therefore requires continuing innovation in products and processes, with a need for consistent and effective research.

The research of the University of Bologna covers a wide range of issues:

- **Laser cutting and welding of thin films** for single and multi-layer films of thickness < 1 mm. Applications include MEMS and electronics, battery fabrication and product packaging, exploiting different wavelengths and pulse durations, from milliseconds down to femtoseconds.
- **Cutting and welding of bulk metals**, applied to a wide range of materials from alloy steel to alloys of Al, Cu, Ni, Ti and Mg using multi-kW, high brilliance industrial CW and "quasi-CW" laser sources.
- **Ablation & Micro-Machining** to achieve machining or modification of non-conventional materials such as semi-conductors, ceramics and glass or metals, under short and ultra-pulse exposure.
- **Surface heat treatment**: applications involving microstructural modification via localised surface heating. it is an optimum technique for obtaining selective, precisely defined regions of high surface hardness on geometrically complex steel and cast iron parts. It is also possible to select process parameters to obtain localized softening of material via microstructural modification.
- **Additive manufacturing for industrial mechanics**: redesign and fabrication of complex and high added value components for packaging machines and metal cutting complex tool.
- **Additive manufacturing in the field of biology** centred on the manufacturing of polymeric scaffolding for cellular regeneration, both in vivo and in vitro, via ultra-short pulse laser exposure, and around biomechanics applications based on the fabrication of Co-Cr prostheses for total ankle replacement.
- **Robotics**: replication of the human ability of manipulation, advanced vision systems, models for path optimization, haptic abilities, modelling and control for stability and performance, simulation environments, cooperative telemanipulation.
- **ICT for advanced production systems**: monitoring and control of industrial processes, diagnostic and supervision methods and algorithms for faults detection.
- **Process simulation** numerical simulation of manufacturing processes, in many fields of industrial application.

HIGHLIGHTS

Research and Innovation projects funded under Horizon2020:

REMODEL Robotic tEchnologies for the Manipulation of cOmplex DeformablE Linear

CLOUDIFACTURING Cloudification of Production Engineering for Predictive Digital Manufacturing

IOTWINS Distributed Digital Twins for industrial SMEs