



## THE INCLAD ONLINE MONITORING PROCESS

### Task

Laser Metal Deposition (LMD) is being increasingly used to plate heavy-duty interior surface areas, for example, of bearings, housings or cylinder bores. Specially developed internal coating optics have made this hard cladding and repair technology available for high-quality components, whose inner surfaces could not previously be accessed with standard heads. The objective of the »LASHARE-INCLAD« project is to integrate sensors and systems for coaxial process monitoring so that the machine operator can observe the process online and, thus, better control it.

### Method

The INCLAD optics were developed and designed in coordination and cooperation with the system supplier and industrial user. So that the process could be safely transferred, the system configuration was conceptualized and operated according to the industrial user's requirements. The technology readiness level (TRL) and the production acceptance test were conducted by the supplier as well as by the industrial user.

### Result

The INCLAD 1500 optics allow internal coating in tubes or in tubular workpieces with a length of up to three meters. A 4 kW fiber laser as well as a 4 kW diode laser can be used as a beam source. To monitor the stability and quality of the INCLAD process online, the thermal radiation emitted by the weld pool is detected with a pyrometer coaxially through the INCLAD 1500 optics and is spatially resolved with a high-speed CMOS camera. If defined control limits are exceeded, the machine operator will either be alerted or the INCLAD process automatically stopped.

### Applications

The INCLAD process can be used to repair high-quality workpieces whose inner surfaces have to meet strict requirements in terms of wear and corrosion. Examples can be found in the oil and gas industry, extruder barrels in plastic injection molding or sliding bearings in machine tools.

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1 INCLAD 1500 optics.

2 Inner coating of an oil drill bit.