

Laser

Heat

Treatment



Fraunhofer

USA

Center for Coatings and Laser Applications

Laser Beam Hardening

A laser beam can be used for transformation hardening of ferrous materials such as hardenable steels and cast irons. Laser hardening improves the wear resistance of surfaces and increases the service life of parts. The technology is especially suitable for selective hardening of complex shaped parts, bores or edges, and parts where low distortion is critical.

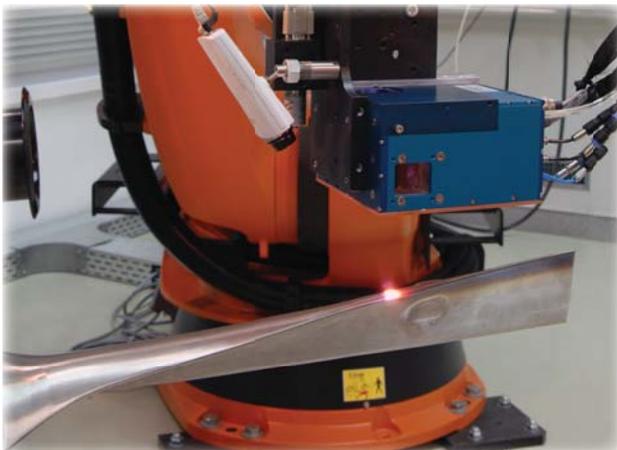
Robotic systems offer low cost system technology and high flexibility. Fraunhofer offers integration of pilot laser hardening systems with process control tools to make processing easier and more reliable.

Process Advantages

- Outstanding wear properties
- Self quenching process
- Minimal loss of part ductility
- Minimal post-process machining

Laser Hardening of Turbine Blades

Laser hardening can be used to minimize erosive wear on the leading edges of turbine blades used in power generation applications. The laser process minimizes heat induced distortion, eliminating the need for straightening. Martensitic and precipitation hardening steels can be hardened with the process. Laser hardened blades have improved fatigue strength and a low loss of ductility compared to conventional flame hardened blades.



Robotic Laser Hardening System with LASSY Scanner



Laser Hardening

Laser Hardening of Metal Forming Tools and Machine Components

Wear surfaces on forming and trim dies can be hardened with robotic laser hardening systems. The low heat input of the process leads to minimal part distortion, and the process can be controlled with temperature monitoring systems to prevent melting of edges.



Laser Hardened Trim Die



Laser Hardening of Grooves

The laser is an ideal tool for hardening of challenging geometries on machine components, such as edges, corners, or recessed features like grooves or bores.



Making innovation a reality

Laser

Heat

Treatment

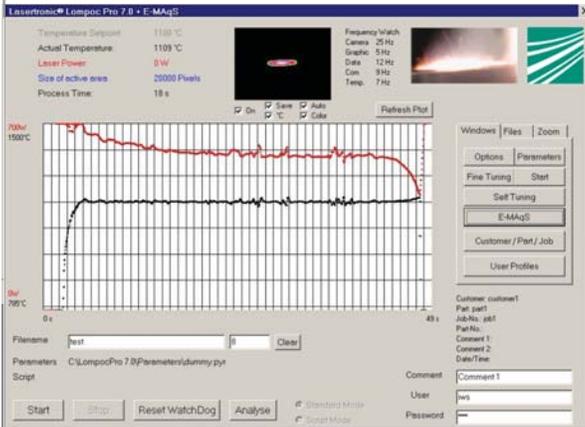


Fraunhofer

USA

Center for Coatings and Laser Applications

Process Control / Temperature Measurement



Control Screen Lompoc Pro

Temperature Measurement can be carried out using pyrometer or camera based systems. For some applications pyrometers can have the disadvantage that they measure the average temperature in a field, which can result a melting of surfaces in an inhomogeneous temperature field.

Fraunhofer has developed the E-MAqS CCD camera system, which can resolve the surface temperature over an area with a resolution of 0.1 mm.

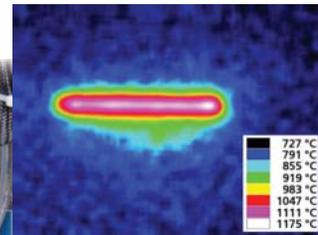
The information from the camera is fed to the Lompoc Pro control software, which creates a closed loop control of the laser power to regulate the surface temperature during hardening.



Temperature Measurement System E-MAqS

LASSY Beam Scanning System

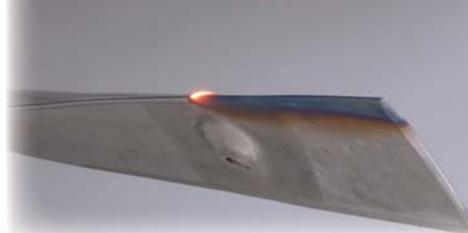
The width of the track produced by laser hardening can be controlled with the use of a beam scanning system. Fraunhofer offers the LASSY beam scanning system, which enables the user to adjust the track width to the application without having to switch optics. A track width of up to 60 mm can be achieved, with up to 6 kW of laser power.



Thermal image with scanning system LASSY



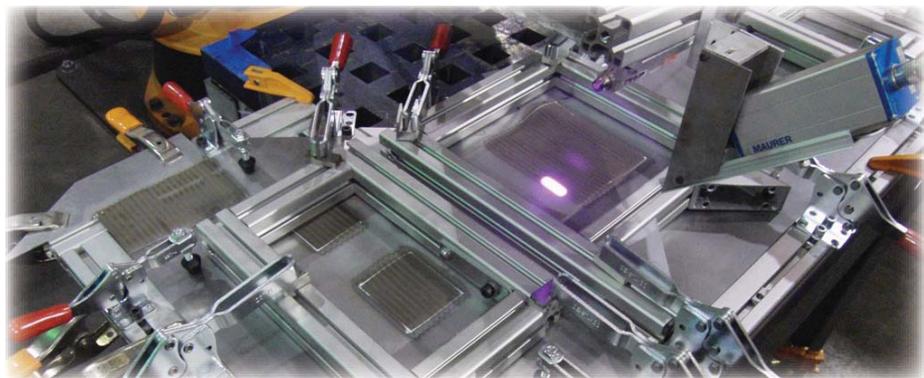
Laser Hardening with Variable Track Width



LASSY Scanning Hardening System

Laser Softening

Lasers can also be used to locally soften & anneal high strength steels in order to improve their formability or mechanical properties. This can be implemented on a wide range of materials including dual phase and hot stamping steel grades for automotive sheet metal applications.



Laser Softening of Automotive B-Pillar

Making innovation a reality