Laser Hardening
The innovative hardening technology

ThyssenKrupp Drauz Nothelfer is running a laser system for hardening of dies and other work pieces at its plant at Wadern-Lockweiler. The size of the laser safety cabin is 8 m x 6 m x 5 m (L x W x H). The parts dedicated for laser processing will be loaded on a rail based transportation wagon designed for a maximum load of 25 tons. Loading and unloading is performed by a crane outside of the laser safety cabin. The working area of the system is 6 m x 3.5 m x 1.5 m. It is dimensioned so large that complete side-panel dies can be laser processed in one operation sequence without interruption caused by a repositioning of the die due to access problems. Thus, the laser system belongs to the largest of its kind throughout Europe.

A number of fixing devices allow laser processing also of small size parts like shafts, cam discs, gear wheels, punches etc.

A cartesian robot, combined with a diode laser, runs on a 6 m long linear axis that is mounted below the laser cabin's ceiling. The hanging-down configuration of the robot increases the system flexibility and accessibility to all component areas.

The laser provides a rated output power of 3000 watts. There are several focussing heads available for producing hardening tracks of different width. Currently, the maximum hardening track width is 25 mm. In case that large work piece areas need to be hardened, several tracks can be positioned side-by-side.

Did we spark your interest?

Get your own picture of our laser hardening device.

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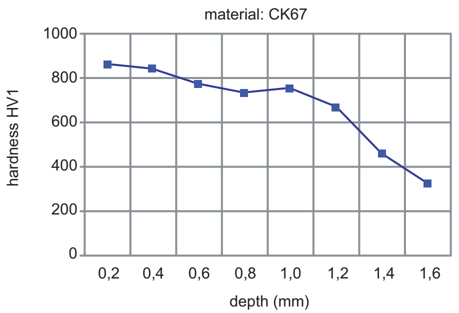
Laser hardening increases resistance to wear and tear

Laser hardening is a method for improving the wear and tear behaviour of components. Especially forming and stamping dies are subject to increased abrasion during production, so it is meaningful to laser harden these panels in order to achieve a higher lifetime.

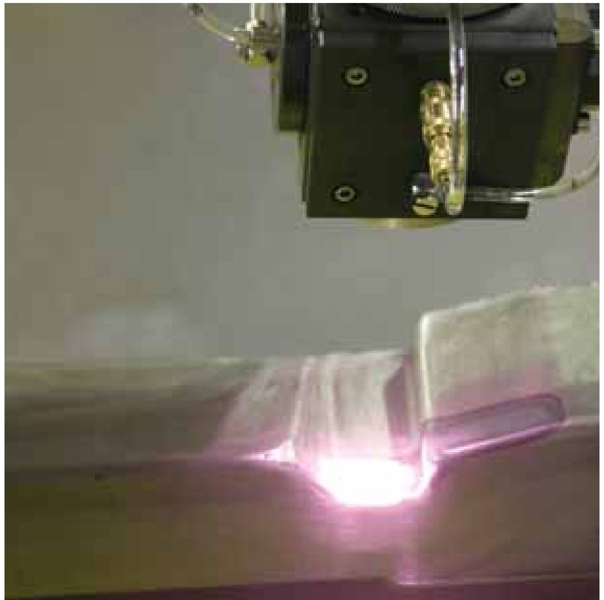
Both steel and cast iron can be hardened with this method. The pre-condition for the hardening operation is a minimum carbon content of 0.25 %. To guarantee a constant edge layer hardness, the material has to have a tempered structure. Examples for materials that are well dedicated for being hardened are 42CrMo4, C45, CK67, 100Cr6, GGL25 or GGG70.



About the functioning of laser hardening

The panel surface will be highly heated by the laser beam for a very short time. Thereby, the temperature increase rate is much more than 1000° C per second. However, the melting temperature of the material may not be exceeded. Due to the rapid process, the inside of the component remains cold. The rapid temperature compensation between the component's edge layer and the inside of the component causes a self-quenching that creates an edge layer with a transformed structure. Its hardness is exceeding the hardness of the basic material by a factor 2 to 3.

The hardening depth can be controlled by the processing parameters. Furthermore, it depends on the component's mass and thus of the self-quenching level. For steel, the maximum hardening depths are approx. 3 mm, for cast iron up to 2 mm can be realised.



Specific hardening of the working surfaces

For the laminar processing of the abrasion areas, the laser beam will be focused to a rectangle by a special focussing optics with which the panel will be processed. The thus generated hardening path corresponds to the width of the rectangle that itself can be adapted to the geometry of the work piece by changing the optics.
Hardening only takes place where the laser beam hits the material, so hardening can be limited to the abrasion areas of the work piece.

Advantages of laser hardening are:

- saving of time and costs by selective hardening
- significant reduction of the heat quantity inserted into the component
- minimisation of the thermal distortion
- saving of time and costs by reducing or eliminating rework
- constantly high product quality due to process control (robot control, pyrometer controlled hardening temperature)
- high flexibility and efficiency also for smaller lot sizes