

# ELECTRON BEAM HARDENING AND HARD COATING FOR HIGHLY STRESSED TOOLS AND COMPONENTS

With electron beam hardening it is possible to selectively harden steel tools and components – even through a PVD or PACVD coating. As part of a project funded by the DFG the Fraunhofer IST together with the Bergakademie Freiberg is investigating methods combining coating and hardening which maximize the resistance of tools and components to wear.

## Surface hardening and coatings

Surface hardening can increase the performance and the wear resistance of many components and tools, especially when through-hardening is not possible or not wanted. When this is combined with a hard coating the component gains a considerable improvement in its wear properties. This effect has been known for a fairly long time with nitrided and coated tools (duplex method), as for example with tools used in sheet metal forming.

## Surface hardening with the electron beam

Electron beam treatment offers some entirely new possible applications. The advantages:

- Fast, precise positioning of the electron beam
- Material-specific hardening
- Coatings through which the beam passes remain for the most part unaffected

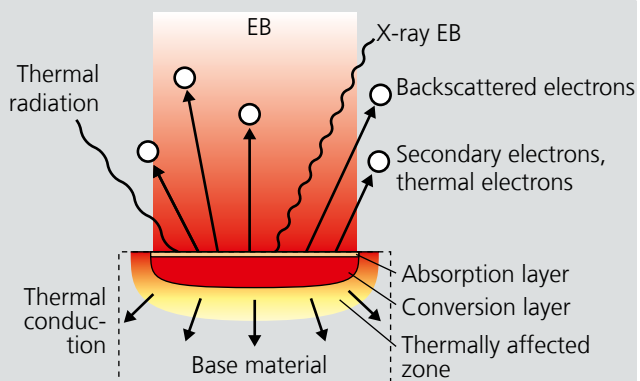
- Warping and loss of core hardness due to the minimum thermal input is not a problem
- No tempering and / or mechanical reworking is necessary

Our project partner, the Bergakademie Freiberg Technical University, has been working successfully for many years in the field of electron beam surface hardening.

## Outcome and benefits

A coated surface which has been surface-hardened locally, either beforehand or subsequently, is particularly resistant to peak point loads. The TiAlN coatings investigated within the context of our project which have different Ti/Al ratios exhibit adherence properties at least equally as good as those produced by a combination of nitriding and coating. Subsequent electron-beam hardening is of particular interest for those steels which would lose their hardness again during high-temperature coating. Components treated in this way are especially suitable for the fields of solid-forming, cutting, guides and bearings as well as in the drive train.

Generation of martensitic supporting layers for hard coatings for property optimization of outer layers by means of locally defined electron beam (EB) hardnesses.



- 1 Result of the Rockwell adhesion test as per VDI 3824, before electron beam treatment.
- 2 Adhesion test after electron beam treatment.

## CONTACT

Dipl.-Ing. Kai Weigel  
Phone +49 531 2155-650  
[kai.weigel@ist.fraunhofer.de](mailto:kai.weigel@ist.fraunhofer.de)