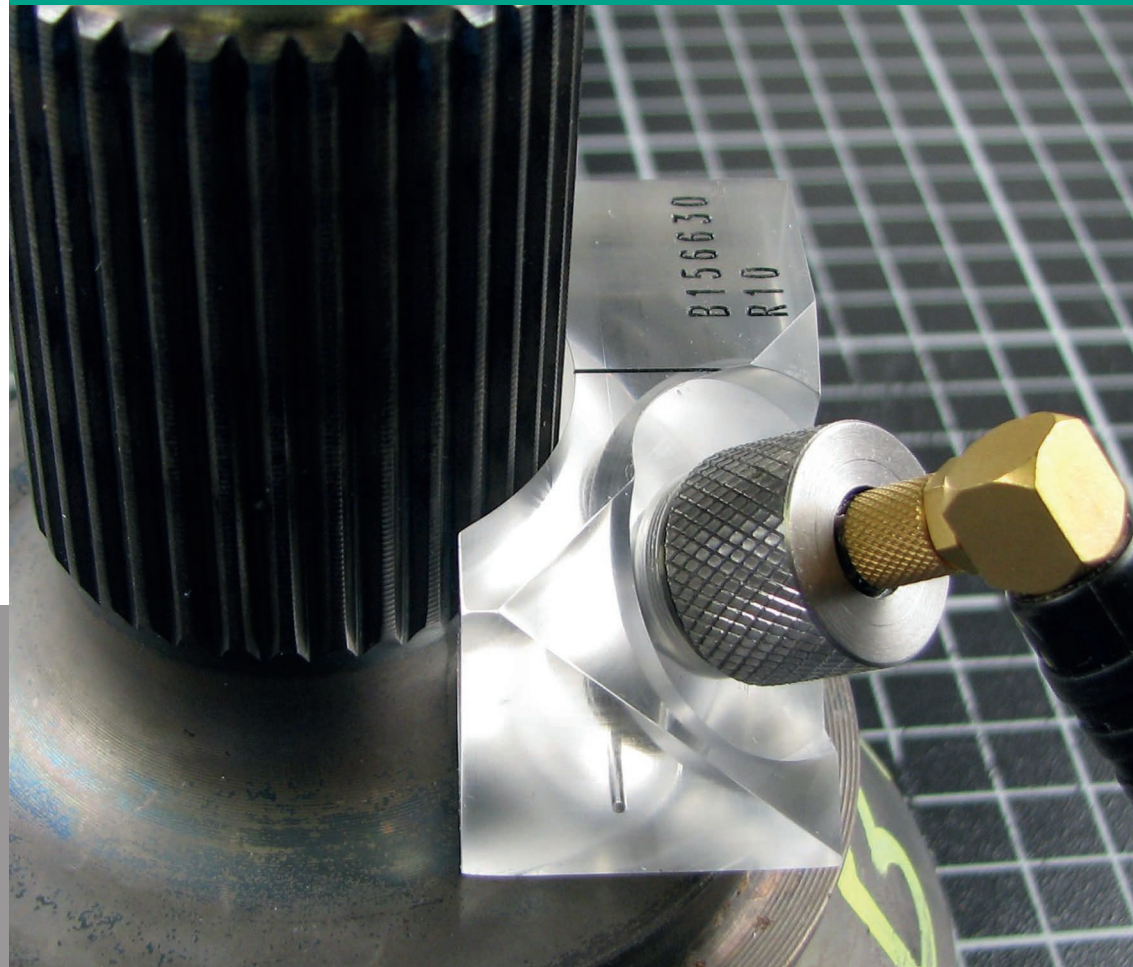




SURFACE HARDENING DEPTH (SHD)

NONDESTRUCTIVE INSPECTION OF INDUCTIVELY HARDENED PARTS AND COMPONENTS USING ULTRASONIC BACKSCATTERING



Are you already familiar with our industrial-grade accredited inspection services?

- Accredited laboratory in line with DIN EN ISO / IEC 17025, to qualify and validate new non-destructive testing (NDT) processes for industrial applications
- Accelerated time-to-market and opportunity for qualified, norm-compliant deployment in industrial applications as well as for new in-house developments or custom adaptation of innovative NDT technologies, even in fields where norms have not been established
- Certification of the corresponding quality management system in accordance with DIN EN ISO 9001



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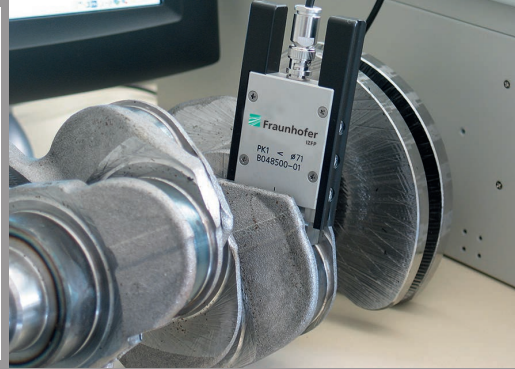
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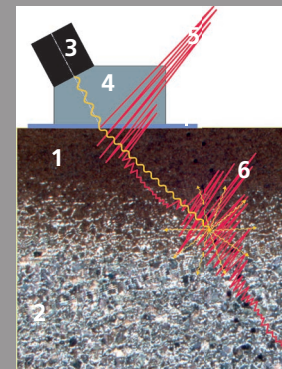




P3123: Mobile SHD inspection device

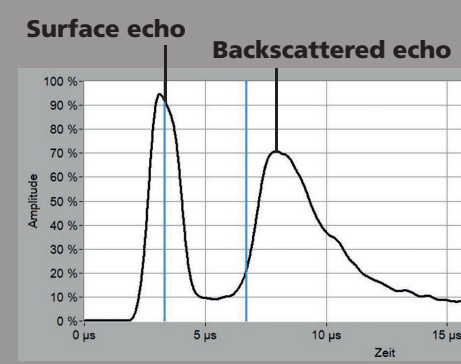


Crank shaft inspection using SHD sensor



Principle of ultrasonic backscattering

(1 – hardened layer, 2 – bulk material, 3 – ultrasonic transducer, 4 – wedge, 5 – surface echo, 6 – backscattered echo, 7 – couplant)



Results display, A-Scan

Situation

Fields of application for surface hardening:

- Surface hardening optimization
- Improving fatigue resistance and roller strength through compressive residual stress
- Friction properties optimization
- Improving wear and corrosion resistance

For high-quality surface hardened products, it is crucial to manufacture a hardened layer with a defined thickness. Without nondestructive methods, quality assurance requires destructive testing of random samples, a time-consuming and costly approach with relatively low throughput.

Solution

As an alternative to destructive techniques such as optical analyses or hardness depth profiling, the surface hardening depth (SHD) is determined with ultrasonic time-of-flight measurement. This non-destructive technique uses backscatter signals out of the transition zone between the hardened layer and the base structure, which represent the corresponding hardening depth. Using the mechanical and structural differences between the microstructures of the surface hardened layer and the base material, in combination with ultrasonic frequencies optimized for backscattering, the customer achieves reliable and reproducible SHD measurements.

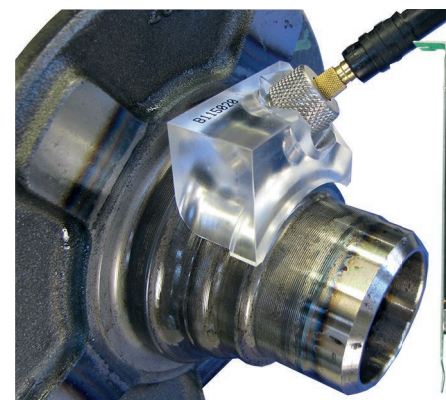
With measurement systems that rely on this effect, the SHD is determined by the ultrasonic time-of-flight evaluation between the surface-signal and the backscatter-signal from the transition zone. Considering the material-specific ultrasound velocity, the surface hardening depth is calculated directly. This state-of-the-art ultrasonic SHD method is in high demand in the energy sector, in the production of large roller bearings and in the manufacture of truck and automobile crankshafts. Our innovative technology is also making inroads in other industries for customized solutions.

Requirements

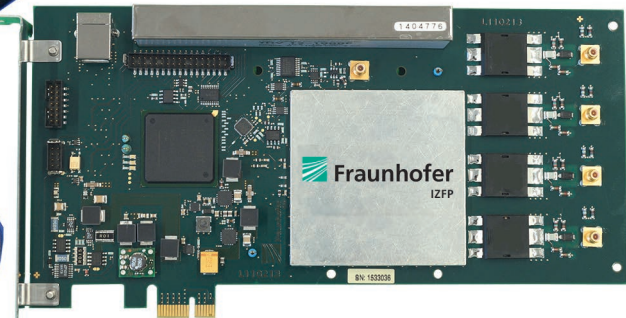
- Tight microstructure gradient between the hardened layer and base structure, such as through induction hardening
- One-off feasibility study of “good components” for comparison purposes

Advantages

- Fraunhofer Institute for Nondestructive Testing IZFP has more than 30 years of experience with customized ultrasonic hardware and software
- Fraunhofer IZFP designs and manufactures optimized ultrasonic electronics
- Systems for automated (Fraunhofer IZFP) and manual testing (via partners) are available
- No calibration of reference parts with defined hardness
- Impartial, user-independent measurement technique



Shaft inspection using SHD sensor



SHD assembly HVUT