DVS SLV HALLE

MATERIAL SCIENCE

Residual stress measurement

in SLV Halle GmbH

Since 2009, our department of Materials Sciences possesses technology to determinate residual stresses in samples and components non-destructively. The used X-Ray diffractometer combines the benefits of high-precision laboratory measuring with the advantages of transportable equipment. Knowing the magnitude of residual stresses is indispensable because of the huge influence on the permissible load factor of welded constructions.

Basic principle

In the process of radiographic measurement residual stresses are empirically demon-strated by means of high-energy radiation in quality and quantity. In materials with a crystal lattice stresses are the macroscopic effects of microscopic changes in the lattice. Consequently, only materials with crystalline or partly crystalline microstructure can be measured. The information depth of this method comprises only a few micrometers and strongly depends on the material properties.

Hardware

For the measurement of residual stresses after the method described above, an X-ray diffractometer is used. These so called XRD-devices can be stationary, mobile or both and exists in different versions on the market.

Fig 1: X-Ray diffractometer

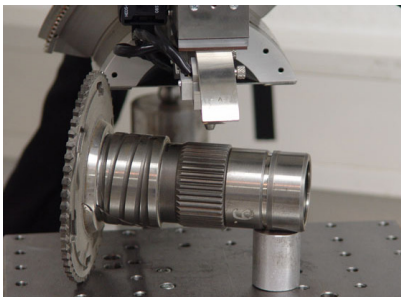

Fig 2: Measurment on a gearwheel

Practical Application

In this process the measurement accuracy and measurement time critically depends on the parameters of exposure time and angular resolution. Typical measurements are conducted as depth profiles, which means as a stress curve into the depth of the material at a specific area (normally only to a few millimeters) or stress distribution across the sample surface. Measurements at critical points, like the tooth root of a gearwheel, are very common too. For all measurements, the validity and accuracy of the results is critically dependent on the surface condition respectively surface preparation.

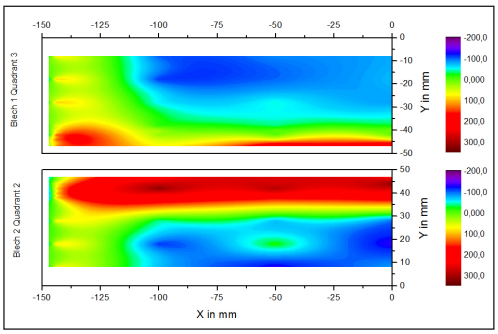

Fig 3: Residual stress distribution at the edge of a thermal cut

Services of the SLV

- Near surface measurements (e.g. residual stress distribution on metalplate surfaces)
- Determination of depth profiles
- Measurements at SLV Halle (laboratory) or on location

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Destructive material testing:

- Investigation of mechanic-technologic values under German, European and international guidelines
- Fatigue endurance limits and endurance strength of materials, welded joints and components
- Strength analysis of welded components and other constructions
- Experimental testing of complete components by simulation of the operating conditions on conceptualized test fields
- Numerical strength analysis of welded components and other constructions (e.g. finite element method; FEM)

Non-destructive material testing:

- Non-destructive testing as part of construction supervisions
- Locally non-destructive testing
- Preparation of test instructions and technologies
- Testing of laser-welded joints
- Testing of spot welded joints
- Radioscopic testing of welded joints and castings
- Expertise and control of non-destructive material testing

Welding metallurgy:

- Determination of the chemical composition of basis materials and welding material by use of latest emission spectrometry
- Development of metallographical workings to evaluate structure and metal materials
- Low load and micro hardness testing on metallographic specimen
- Failure analysis and expert activities
- Welding metallurgy advice

Courses and further training:

- TÜV Cert® recognized educational institution for non-destructive testing inspection personnel
- Conduct of special training courses for qualification of welding professionals
- Accredited training facility for requalification for materials tester with IHK conclusion

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