



STRESSTECH BULLETIN 7

Measuring residual stresses inside a cylindrical part

The Importance of Residual Stresses

Independent of external loads, there are internal stresses inside structures and materials. These stresses are called residual stresses. Even though “stress” is an abstract term, the plural form “residual stresses” is often used. Residual stresses / Residual Stress terms were first mentioned in literature already in 1841. Since then, the importance of residual stress has become a well-known fact.

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Residual stresses, depending on their sign, magnitude and distribution, can be either beneficial or detrimental. It is engineers' responsibility to avoid the harmful effects and introduce the favorable effects of them.

In practice, residual stresses are unavoidable. However, it is possible to control or measure them to avoid their unwanted results. It is also possible to introduce them intentionally with suitable processes.

Such processes as shot peening, laser peening, low plasticity burnishing and autofrettage are widely used methods to extend the fatigue life of the critical components such as turbine blades, gear teeth or common rails.

There are also methods available to relieve the existing harmful stresses such as stress relief heat treatment, cryogenic treatment and vibratory stress relief.

The most important way to control and analyze residual stresses is to measure them. There are different methods available to measure residual stresses. The common methods are X-ray diffraction, hole-drilling, neutron diffraction, contour, slitting, ring core, hole drilling with ESPI, deep hole drilling and Barkhausen noise.

Residual stress is a complex issue and requires various departments' attention such as quality control, manufacturing and design. All of these departments need to work together to avoid to have problems with residual stresses.

Residual stresses have various effects on the performance of materials. Fatigue, stress corrosion cracking, failures, distortion, structural stability are the common effects.

Residual stresses often cause costly hidden problems which effects will be seen during the service life of the components.

Stresstech is a research oriented company with 34 year's experience in residual stress engineering. Feel free to contact us to learn more about residual stresses and their measurements.

www.stresstech.com

Sources

Introduction to residual stress, Prof. Dr. rer.nat. Dr.-Ing. E.h. Eckard Macherauch war Leiter des Instituts für Werkstoffkunde der Fakultät Maschinenbau an der Universität Karlsruhe (TH), published in Advances in Surface Treatments: Technology-Applications-Effects Vol. 4, 1987

Handbook of Residual Stress and Deformation of Steel, ASM International, 2002