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Metall entspannen mit Vibration

REPORT WM MEASURE VOLTAGES 886

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1 X-RAY RESIDUAL STRESS MEASUREMENT

In this experiment, the basics of X-ray residual stress measurement are developed and discussed the possibilities and limitations of this measurement method using the example of a surface hardened sample.

1.1 The term "residual stresses"

Under residual stress is generally understood stresses in a component to which no external mechanical stresses acting and subject to a constant temperature field spatially and temporally. The costs associated with the residual stresses internal forces and torques in mechanical equilibrium.

Depending on their scope residual stresses in such a 1st, 2nd and 3rd species be divided into:

Residual stresses 3. Type (Micro inhomogeneous residual stresses) are micro-scopic nature. To change the amount and / or direction within a grain. They are

formed of a dislocation near a lattice defect, for example.

Residual stresses 2nd type (homogeneous microstructure residual stresses) are constant within a grain, but may vary from grain to grain. They are a result of the Streckgrenzenanisotropie, ie, the yield point of different phases in the material is different, thereby occurs a plastic deformation inhomogeneous. Reason for these residual stresses can be different thermal expansion coefficients of different phases in multiphase materials.

Residual stresses 1. Type (macro-stresses) extend over macroscopic areas of a workpiece, that is, over several grains. Residual stresses 1st kind arise, for example during forming, mechanical machining or during the heat treatment of metallic materials.

Figure 1 shows the schematic course of the voltages along a cutout structure with the corresponding definition of the residual stresses 1st, 2nd and 3rd type.

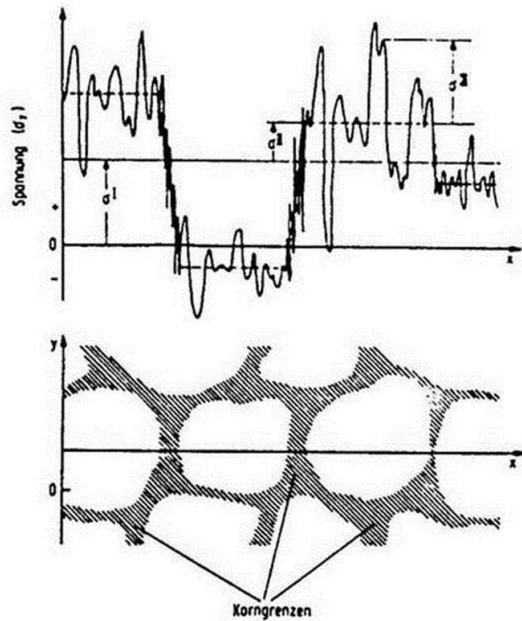
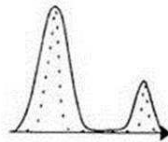


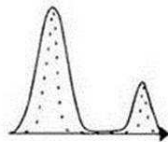
Figure 1: Schematic of the internal stresses along the surface of a structural detail of a metal sample

Eigenspannungen 1., 2., und 3. Art

Eigenspannungen 3. Art



Eigenspannungen 2. Art



Eigenspannungen 1. Art

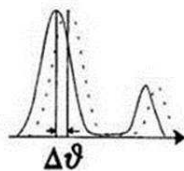
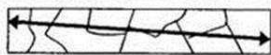


Figure 2: Effect of residual stresses 1st, 2nd and 3rd species on the peaks of X-ray diffraction pattern

As several grains are detected by the X-ray beam in the X-ray diffraction of polycrystalline materials in general, residual stresses are indistinguishable 2nd and 3rd type and superimposed on the residual

stresses 1. Art. due to a higher spread of lattice spacings they lead to a broadening of the peaks. Residual stresses 1st kind, however, cause a shift of the peak maxima to DJ, since all the reflecting lattice planes of a lattice planes are distorted in the same way. This is illustrated in Figure 2.

2 REFERENCES

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End report WM 886, measure voltages
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