Neutrons and X-rays for Microstructure and Strain/Stress Analysis in Materials

Walter Reimers, *Technical University Berlin, Metallic Materials, Ernst-Reuter-Platz 1, D-10587 Berlin, Germany.* E-mail: walter.reimers@tu-berlin.de

The microstructure and the strain/stress distribution in engineering materials can be adjusted as a function of the materials processing technology and its parameters. Since the microstructure and the strain/stress distribution in components are responsible for macroscopical properties, e.g. yield strength fatigue life, the property profile of components can be optimised in view of the in-service condition. The optimation requires the detailed knowledge about microstructural parameters like phase composition, grain sizes, dislocation densities, texture, strains/stresses and their relationship to the macroscopical properties. The various contributions to this field using X-ray and neutron diffraction are presented. Special emphasis is put to the rapid development of the microstructural and strain/stress analysis due to the increasing use of synchrotron X-radiation which enables new measuring techniques but also in-situ analysis of microstructural alterations and strain/stress developments. Examples are given for selected material systems like Mg-alloys and brass alloys.

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