NEW DEVELOPMENTS AT MATERIALS SCIENCE DIFFRACTOMETER STRESS-SPEC AT FRM II

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The Materials Science Diffractometer STRESS-SPEC at the German neutron source FRM II is designed to meet the demands of non-destructive residual stress and texture determination by diffraction methods.

With slit based optics used at STRESS-SPEC accurate residual stress determinations can be carried out even with small gauge volumes down to 1x1x1 mm³ [1]. For measurements deep inside big components (e.g. ship crankshafts, engines…), however, the spatial resolution is often limited by the instrumental set up. The slits, for example, have to be positioned relatively far away from the measurement position resulting in a blurred definition of the gauge volume due to divergence of the neutron beam. In addition the maximum of neutron flux is found at the slit exit.

The replacement of the primary slit system with a parabolic focussing guide enables both a better definition of the gauge volume and a maximum of neutron flux at the measurement position as the focal point of the guide is several centimetres away from the end of the tube [2]. First experimental results for a prototype parabolic guide measured at STRESS-SPEC are in good agreement with simulations and will be presented in this contribution as well as the simulations of an optimised parabolic guide for STRESS-SPEC.

Furthermore, we will show the enhancement of the capabilities by STRESS-SPEC in sample positioning using a robotic system. This system will be added to the conventional goniometers (Eulerian cradles) on STRESS-SPEC and is optimised for sample weights up to 50kg, speed, translation range and positioning accuracy for 3-D residual stress determination and texture analysis respectively.

References

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