ESRF	**Experiment title:** **Scanning Micro-Focus Beam Small Angle Scattering investigations of materials with structural gradients**	**Experiment number:** HS-154
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Shifts: 12	**Local contact(s):** C.Riekel, P.Engstroem	*Received at ESRF:*

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Report:

The knowledge about gradients in the defect structure in materials are often needed to understand the properties of theses materials.

In reactor pressure vessel steels a heat affected zone occurs in locations of the base metal which is adjacent to the weld. The heat affected zone is know as the most critical position for crack initiation and propagation. In order to investigate the gradient in the defect structure inside of the heat affected zone the small angle X-ray scattering (SAXS) was measured along a line perpendicular to the weld - base metal interface with a beam size of about 10 µm in diameter and a step width of 50 µm. The measurements are started in the base metal and end after 4.5 mm in the weld metal. The data analysis is yet beginning. First impressions can be given. The Fig. 1 a,b and c show the SAXS rawdata of locations in the base metal, the heat affected zone and the weld metal. In the base metal strong streaks, caused by grain boundary scattering can be found. In the heat affected zone the scattering pattern are more or less isotropicaly. In the weld metal very weak streaks can be found.

At second nitride layers in bainitic and austenitic steel was investigated. In the bainitic steel the layer has a thickness of about 450 µm. The hardness decrease slowly with increasing distance to the surface of the sample.

In contrast to this the nitride layer in the austenitic steel is only about 50μm thick and show a step function of the hardness via the distance to the surface. Like at the first sample the SAXS intensity was measured along a line perpendicular of the layer with the same beam cross section but with a step wide of 10 μm. The Fig. 2 a and b show the scattering patterns (rawdata) of two different locations in the nitride layer in the austenitic steel (a) and (b) and of the bulk of this steel (c). The scattered intensity in the layer seem to be anisotropically and is much stronger than the intensity scattered from the bulk of the material. The data correction including the correction of the detector sensitivity and the empty beam subtraction is in progress but not finished yet. A quantitative analysis of the data sets will be given elsewhere.

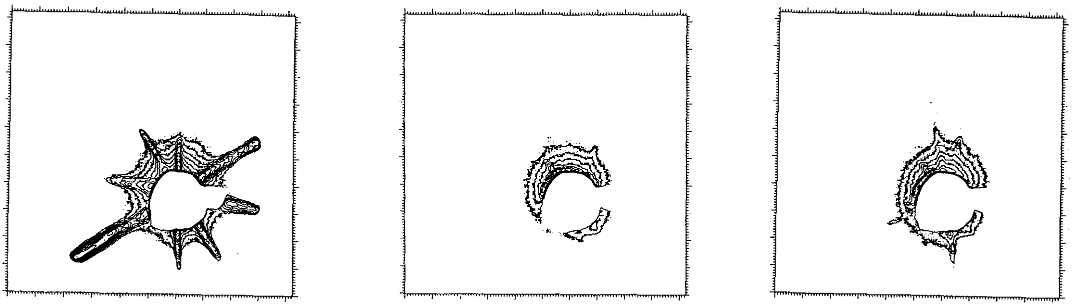

Fig. 1 a, b, c Scattering pattern of the base metal (a), heat affected zone (b) and weld metal (c) of the RPV steel 15Ch2MFA

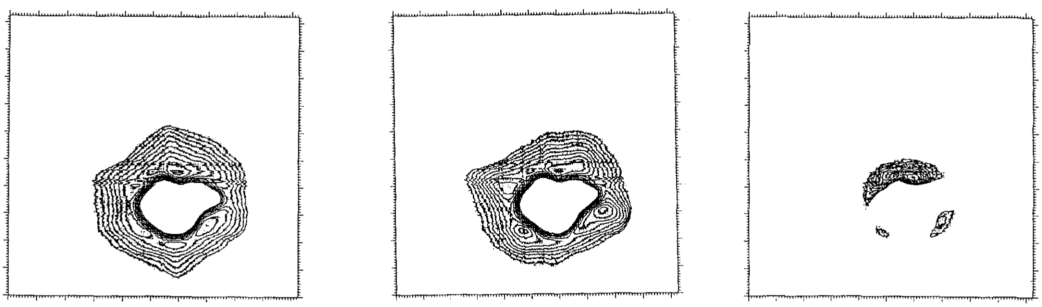

Fig. 2 a, b, c Scattering patterns of two locations in the nitride layer (a,b) and of the bulk of the austenitic steel X10CrNiVl8.10