Using a high-precison robot for texture and strain determination at Neutron Diffractometer STRESS-SPEC

Michael Hofmann*[1], Weimin Gan[2], Heinz-Gunter Brokmeier[3], Lijiu Wang[4], Martin Landesberger[5], and Oguz Kediloglu[6]

[1]Heinz Maier-Leibnitz Zentrum, Technische Universität München (MLZ) – Lichtenbergstrasse 1, D-85748 Garching b. München, Germany
[2]Helmholz-Zentrum Hereon – Germany
[3]Technische Universität Clausthal – Germany
[4]Heinz Maier-Leibnitz Zentrum, Technische Universität München – Germany
[5]Technische Hochschule Ingolstadt – Germany
[6]Friedrich-Alexander-Universität Erlangen-Nürnberg – Germany

Abstract

The Heinz Maier-Leibnitz Zentrum (MLZ) operates at Germany's sole neutron source FRM II the diffractometer STRESS-SPEC optimised for fast strain mapping and texture analyses. The STRESS-SPEC group around Prof. H.G. Brokmeier was the first to pioneer sample handling and positioning via industrial robots at neutron diffractometers (1, 2). However, the current robot is limited to global texture measurements due to insufficient absolute positioning accuracy of up to ± 0.5 mm in some cases. However, to allow accurate strain tensor determination and correct centering of local texture measurements usually, an absolute positioning accuracy of 10% of the smallest gauge volume size – which in case of modern neutron diffractometers is in the order of 1×1×1 mm3 – is necessary. The original robot setup at the neutron diffractometer STRESS-SPEC has therefore been upgraded to a high accuracy positioning/metrology system. We will give a short introduction on the complete measurement process chain for the new robot environment. To achieve a spatial accuracy of 50 μm or better during measurement of the full strain tensor, the sample position is tracked by an optical metrology system and actively corrected, which we will show in detail. In addition, the dedicated sample environment options to extend the scope of applications for texture measurements also towards higher temperature and also tensile loads have been developed for the robot system. These will also be briefly introduced in this presentation.
(1) H.-G. Brokmeier et al., Mater. Sci. For. **652** (2010) pp. 197–201.
(2) C. Randau et al., Nucl. Instr. Meth. A: 794 (2015) pp. 67–75.

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*Speaker