



Contribution ID: 245

Type: **Talk**

The Robot Positioning System at the Materials Science Diffractometer STRESS-SPEC

Tuesday, December 8, 2020 3:25 PM (25 minutes)

The diffractometer STRESS-SPEC is optimised for fast strain mapping and pole figure measurements. Our group was the first to pioneer the usage of industrial robots for sample handling at neutron diffractometers. However, the current robot is limited in its use due to insufficient absolute positioning accuracy of up to ± 0.5 mm. 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 $1 \times 1 \times 1$ mm³ –is necessary to allow accurate strain tensor determination and correct centering of local texture measurements. Therefore, the original robot setup at the neutron diffractometer STRESS-SPEC is currently being upgraded to a high accuracy positioning/metrology system. We will present the complete measurement process chain for the new robot environment. To achieve a spatial accuracy of 50 μ m or better during strain measurements the sample position will be tracked by an optical metrology system and it is going to be actively corrected. The additional use of radial collimators creates more space in the sample environment and enhance the residual stress analysis capabilities for large complex parts. Finally, a newly designed laser furnace can be mounted at the robot flange to conduct texture measurements at elevated temperatures of up to 1300 °C. A brief overview of the STRESS-SPEC instrument and its capabilities as well as first commissioning experiments using the new setup will be given.

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Session Classification: MLZ Users 2020 - Neutron Methods

Track Classification: UM: Neutron Methods