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Correlation of Mechanical Stress and the Positron Lifetime in Aluminum Alloys

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Positron annihilation lifetime spectroscopy (PALS) is a sensitive technique to analyze the type and concentration of lattice defects on an atomic level.

We applied ex-situ PALS to plastically deformed technical Al and Al alloys.

We measured the depth-dependent positron lifetime at the accelerator-based positron source MEPS at ELBE.

For each sample we recorded the tensile stress, and the corresponding stress-strain curves.

This allows us to determine the relation between applied stress, strain and mean positron lifetime.

Thereby we are able to observe the creation and evolution of stress-induced defects in the region beyond the elastic Hook regime of the specimen.

Within this contribution, we also discuss the evolution of the defect population with increasing deformation by examining the intensity change of the different positron lifetime components found in the PALS spectra.

Primary authors: Dr WAGNER, Andreas (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); HUGENSCHMIDT, Christoph; Dr HIRSCHMANN, Eric (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); MATHES, Lucian; Dr LIEDKE, Maciej Oskar (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); Dr BUTTERLING, Maik (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); BURWITZ, Vassily Vadimovitch

Presenter: MATHES, Lucian

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