Contribution ID: **22** Type: **Poster**

Effects of Hydrogen Loading on Lattice Defects in Nickel-Based Superalloys Studied by Positron Annihilation

Tuesday 29 July 2025 19:00 (1h 30m)

Positron annihilation spectroscopy (PAS) is a highly sensitive technique for the detection and characterization of vacancy-like defects in crystalline solids, making it an ideal tool for studying radiation damage and hydrogen-related degradation processes in materials. In this work, we employ PAS to investigate the interaction between hydrogen and open-volume defects in hydrogen-loaded nickel-based superalloys. Pure nickel samples, annealed and loaded with hydrogen, were used as a reference.
Depth-resolved Doppler broadening spectroscopy (DBS) of the positron electron annihilation line allows for the differentiation between (near-) surface and bulk phenomena, while coincidence DBS (CDBS) provides insights into the chemical environment of the positron annihilation sites. The depth-resolved experiments were conducted using the Setup for Low-energy Positron Experiments (SLOPE) of the positron research group at TUM. By variation of the pressure and temperature hydrogen loading was applied to systematically study the interaction of hydrogen with defect structures in nickel-based superalloys. First results will be presented —especially obtained by the depth-resolved methods —to visualize and quantify microstructural changes induced by hydrogen.
This study demonstrates the unique capability of positron annihilation techniques in benchmarking defect models and improving the understanding of hydrogen effects in materials. Such methods are of particular importance to study the (temperature dependent) influence of hydrogen as well as the irradiation-induced defects in materials relevant for nuclear and fusion applications.

Author: PORTH, Kilian (Nepomuc)

Co-authors: Dr MUTSCHKE, Alexander; HUGENSCHMIDT, Christoph; FRITTON, Massimo; GILLES, Ralph

Presenter: PORTH, Kilian (Nepomuc)

Session Classification: Poster Session and Beer