Contribution ID: **126** Type: **Talk (20 min + 5 min discussion)**

# Revealing the effect of hydrogen on CoNiCr-based superalloys by mechanical characterization, neutron and X-ray diffraction

*Monday, 4 December 2023 15:50 (25 minutes)*

Polycrystalline CoNiCr-based alloys show promising properties for future high temperature applications due to their potential to achieve a high y'-volume fraction while retaining a significant processing range. The growing importance on emission reduction through innovative propulsion technologies, such as hydrogen-based aviation fuels or water-enhanced turbofans, requires research into how hydrogen affects the strength and ductility of these alloys.

We conducted a comprehensive investigation into the effects of hydrogen exposure on the polycrystalline CoNiCr-based alloy CoWAlloy3 through a combination of ex-situ X-ray diffraction (XRD) laboratory measurements and neutron diffraction experiments. Our primary objective was to assess the impact of hydrogen on the lattice constants of both the y- and y'-phase. These findings were correlated with tensile tests to evaluate the occurrence of hydrogen-induced embrittlement.

Furthermore, we examined the fracture surfaces of the tested specimens using scanning electron microscopy (SEM) to discern variations in fracture behavior between the reference and hydrogen-exposed samples. Electron backscatter diffraction (EBSD) patterns were acquired at secondary cracks to ascertain whether transgranular or intergranular fracture behavior was present. This multidisciplinary approach allowed us to gain a comprehensive understanding of the hydrogen-related mechanical properties and fracture mechanisms in this alloy.

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**Session Classification:** Material Science

**Track Classification:** Material Science