

Non-destructive stress mapping to address challenges in additive manufacturing

Il Sentiero International Campus, a 100% subsidiary at ECOR International, is an Industrial Research Centre in the field of Surface and Reliability Engineering, Additive Manufacturing and Joining Technologies.

THE PROBLEM TO SOLVE

The Selective Laser Melting (SLM technology), one of the Additive Manufacturing (AM) routes, is implemented at Sentiero. Inhomogeneous shrinkage of printed components is a well-known issue in additive manufacturing processes. Sentiero wanted to measure the residual stress that occurs in samples having different aspect ratios.

A STEP TOWARDS THE SOLUTION

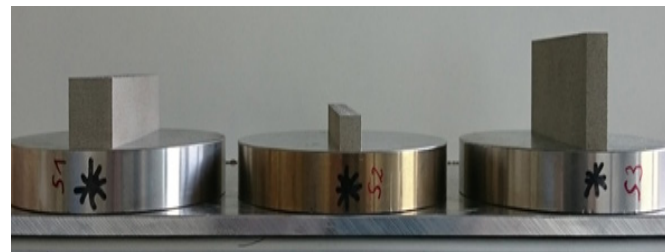
Three bar-shaped samples made of stainless steel, each of them being attached to a base plate of about 10cm in diameter, were investigated at the Institut Laue-Langevin in France using neutron diffraction.

Measurements were performed across the samples and the first millimetres of the base plate, in a true **non-destructive manner**.

THE RESULT

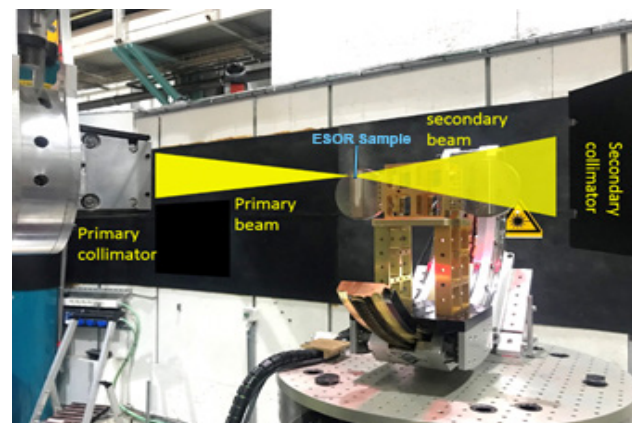
Neutron measurements provided stress values with an average uncertainty of about 40 MPa in the form of maps for the three principal directions selected on the samples.

Variations observed in the direction of the building path provide indications towards optimisation strategies in AM processes and post-processes.



Credit: ILL

Fig.1 The stainless steel samples on their base plate (10 cm in diameter).



Credit: ILL

Fig.2 Set-up for non-destructive stress measurement using the diffraction of neutrons.

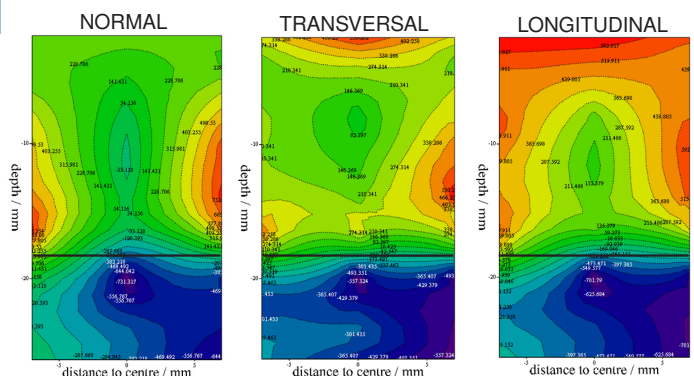


Fig.3 Stress map obtained non-destructively by neutron diffraction in one of the samples for the three principal directions: the position of the interface between the AM part and the base plate is shown as a solid line.

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