ESRF	**Experiment title:** Influence of the alloy microstructure on the residual stress field caused by the shot-peening of a nickel-based superalloy	**Experiment number**: IN 995
Beamline: BM 32	**Date of experiment**: from: Nov 2, 2016 to: Nov 6, 2016	**Date of report**: March 1, 2018
Shifts: 12	**Local contact(s)**: Jean-Sébastien Micha	*Received at ESRF:*

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Report:

Laue microdiffraction was used to determine the full elastic strain tensor of the γ and γ' phases in grains of a nickel-based superalloy with a coarse-grained microstructure. A 'rainbow' filter and an energy dispersive point detector were employed to measure the energy of Bragg reflections (see Figures 1 and 2). For the two techniques, an uncertainty of $\pm 2.5 \times 10^{-3}$ Å was obtained for the undetermined crystal lattice parameter. The measurements showed that the filter method provides better confidence, energy resolution, accuracy and acquisition time. The sensitivity of each method with respect to the γ-γ' lattice mismatch was demonstrated with measurements in samples with average precipitate sizes of 200 nm and 2000 nm. For the 200 nm precipitate size, the lattice mismatch was less than 2×10^{-3} Å and the dilatational strains were close to $\pm 1.5 \times 10^{-3}$ depending on the considered phase. For the 2000 nm precipitate size, the lattice mismatch was close to 8×10^{-3} Å and almost no elastic strain occured in the microstructure.

The results obtained during this campaign were published under the following reference: GaderAltinkurt, Mathieu Fèvre, Odile Robach, Jean-Sébastien Micha, Guillaume Geandier and Moukrane Dehmas, *Full elastic strain tensor determination at the phase scale in a powder metallurgy nickel-based superalloy using X-ray Laue microdiffraction*, J. Appl. Cryst. 50 (2017) 1754-1765

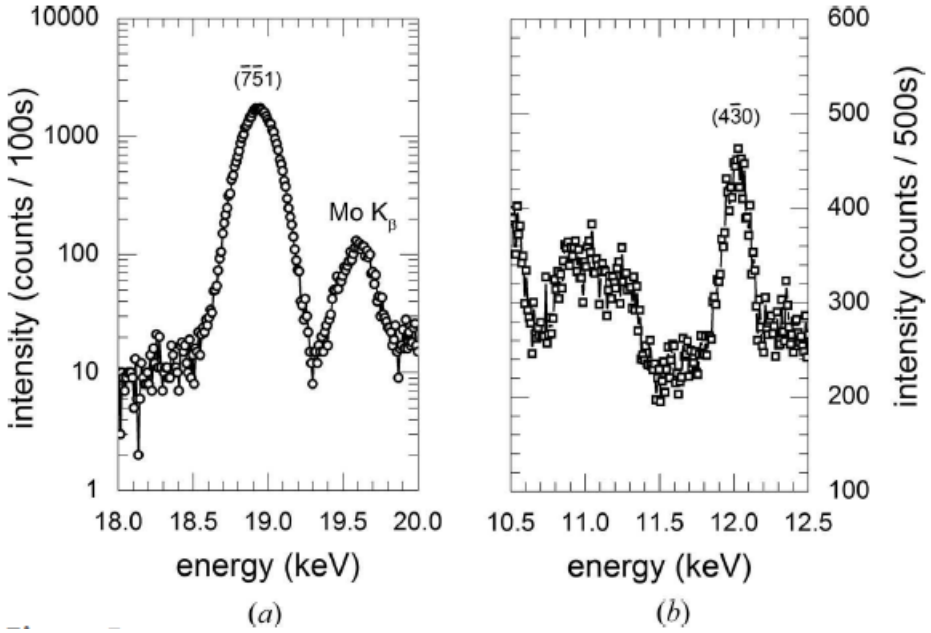

Figure 1: Determination of the energy of Bragg reflections with an energy dispersive point detector (a) the -7-51 fundamental reflection (γ+γ' phases) and (b) the 4-30 superstructure reflection (g' phase only).

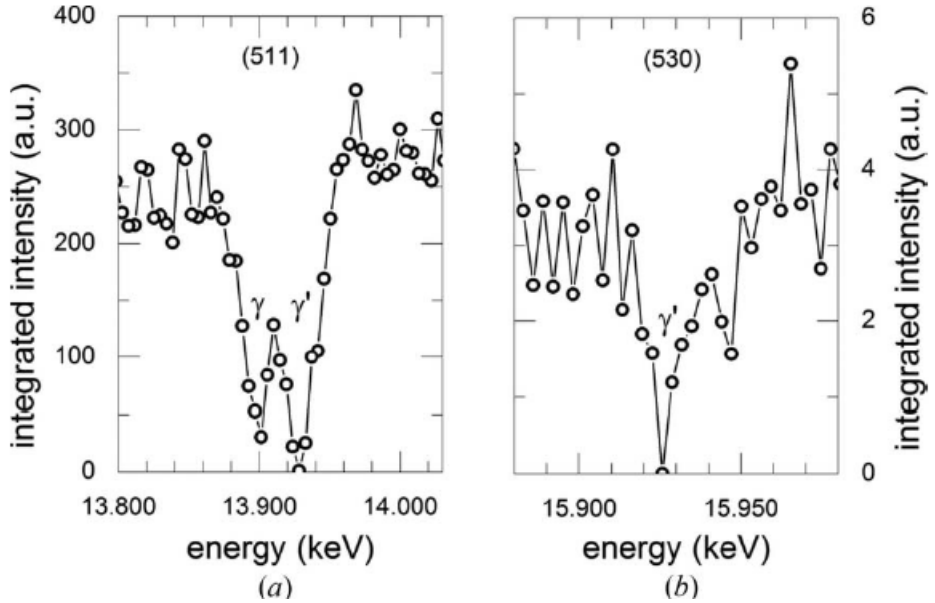

Figure 2: Determination of the energy of Bragg reflections with the Rainbow method (a) the 511 fundamental reflection (γ and γ' phases) and (b) the 530 superstructure reflection (γ' phase only).