

The supplemental data provided in the following tables refer to *ex-situ* experiments conducted at room temperature on the alloy studied in the synchrotron experiments (Alloy 1) and another variant of the nanostructured bainite (Alloy 2). The structures of these samples were as-transformed, without any tempering heat-treatments. The purpose of these experiments was to confirm that the same effects are observed in the *ex-situ* and *in-situ* synchrotron data.

	Alloy 1	Alloy 2
Min. 2θ	40°	40°
Max. 2θ	125°	125°
Source	Cu	Cu
Divergence Slit	0.5°	0.5°
Incident Beam Aperture	10 mm	10 mm
Receiving Slit	0.2 mm	0.2 mm
Anti-scatter Slit	0.5°	0.5°
Step size	0.02°	0.02°
Dwell time	10 s	5 s

Table 1: Parameters used for *ex-situ* X-ray diffraction experiments.

	Cubic	Tetragonal	Orthorhombic
R_{wp}	23.05	22.08	20.98
V_γ	26.5 ± 0.3	28.0 ± 0.2	27.7 ± 0.2
$a_\gamma / \text{\AA}$	3.6143 ± 0.0002	3.6146 ± 0.0002	3.6145 ± 0.0002
$a_\alpha / \text{\AA}$	2.86343 ± 0.00009	2.8560 ± 0.0002	2.8449 ± 0.0003
$b_\alpha / \text{\AA}$	—	—	2.86910 ± 0.00010
$c_\alpha / \text{\AA}$	—	2.8769 ± 0.0005	2.8747 ± 0.00011
c_α / a_α	—	1.0073 ± 0.0002	1.0101 ± 0.0004
b_α / a_α	—	—	1.0085 ± 0.0004

Table 2: Results obtained from *ex-situ* X-ray diffraction of **Alloy 1**.

	Cubic	Tetragonal	Orthohombic
R_{wp}	20.18	19.96	19.62
v_γ	0.214 ± 0.007	0.218 ± 0.008	0.2298 ± 0.0005
$a_\gamma / \text{\AA}$	3.6346 ± 0.00013	3.64403 ± 0.00013	3.63712 ± 0.00012
$a_\alpha / \text{\AA}$	2.86465 ± 0.00010	2.8586 ± 0.0003	2.8478 ± 0.0005
$b_\alpha / \text{\AA}$	—	—	2.872 ± 0.0003
$c_\alpha / \text{\AA}$	—	2.876 ± 0.00076	2.874 ± 0.003
c_α / a_α	—	1.0063 ± 0.0003	1.0093 ± 0.0011
b_α / a_α	—	—	1.0085 ± 0.0011

Table 3: Results obtained from *ex-situ* X-ray diffraction of **Alloy 2**.