**Experimental**

The volume fractions and carbon concentration of the phases present after the heat treatments were determined using a Bruker D8 Advance diffractometer with a position sensitive detector and CuKα radiation. Scans were performed from 35 to 130°, with a step size of 0.02°, a dwell time of 3.5 s, and energy levels from 210 to 220 mV to minimise beta peaks. The samples were rotated at 30 rad-1 and 10 mm slits were chosen to restrict the beam size. After scanning, the simulated slit mode was changed to fixed in order to flatten the background as much as possible.

Samples were prepared by grinding to 4000 SiC paper, polishing to 1 µm, etching in 2% nital, and polishing again to 1µm to get rid of any surface stresses and/or stress induced austenite transformation.

**Results**

Rietveld refinement of all the x-ray diffraction data collected was performed in HighScore Plus according to the method presented in [1] by first fitting austenite to three isolated austenite peaks: 002, 022, and 113. This allowed to obtain the maximum and minimum estimates for the lattice parameter of austenite, which were then used to calculate its carbon concentration through the Dyson and Holmes equation [2]. Since this carbon concentration is inherited by martensite, its maximum and minimum values of tetragonality were obtained by using the Honda and Nishiyama charts [3]. These lattice parameters (aγ, aα’, and cα’) were used to fit martensite, retained austenite, and bainitic ferrite to the whole spectrum. The results suggest there is no martensite formed either after cooling from the austempering temperature or due to surface stress transformation of the retained austenite due to the preparation method followed and its high carbon concentration.

|  |  |  |  |
| --- | --- | --- | --- |
| **Phase volume fraction**  *lattice parameters in Å,* (*carbon concentration in wt%)* | 200 °C | 250 °C | 300 °C |
| Ferrite | **0.79±0.01** | **0.74±0.01** | **0.66±0.01** |
| *a=2.873±0.001* | *a=2.8714±0.0001* | *a=2.8682±0.0001* |
| Austenite | **0.21±0.01** | **0.26±0.01** | **0.34±0.01** |
| *a=3.617±0.001 (Xc=0.85)* | *a=3.6229±0.0001 (Xc=1.03)* | *a=3.6266±0.0001 (Xc=1.14)* |
| Martensite | **0±0.01** | **0±0.01** | **0±0.01** |
| *a=2.848, c=2.960* | *a=2.846, c=2.977* | *a=2.845, c=2.995* |
| Fe3C | **-** | - | **-** |

**References**

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[3] E. Honda and Z. Nishiyama, On the nature of the tetragonal and cubic martensites, Science Reports of Tohoku Imperial University 21 (1932) 299–331.