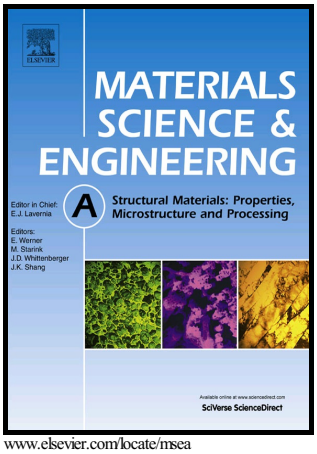
The effect of Nb solute and NbC precipitates on dynamic and metadynamic recrystallisation in Ni-30Fe-Nb-C model alloys

Parvez Mannan, Casillas Gilberto, Elena V. Pereloma



www.elsevier.com/locate/msea

PII: S0921-5093(17)30729-3
DOI: http://dx.doi.org/10.1016/j.msea.2017.05.099
Reference: MSA35115

To appear in: *Materials Science & Engineering A*

Received date: 7 March 2017
Revised date: 24 May 2017
Accepted date: 25 May 2017

Cite this article as: Parvez Mannan, Casillas Gilberto and Elena V. Pereloma, Th effect of Nb solute and NbC precipitates on dynamic and metadynami recrystallisation in Ni-30Fe-Nb-C model alloys, *Materials Science & Engineering A,* http://dx.doi.org/10.1016/j.msea.2017.05.099

The effect of Nb solute and NbC precipitates on dynamic and metadynamic recrystallisation in Ni-30Fe-Nb-C model alloys

Parvez Mannan[a1*], Casillas Gilberto[b], Elena V. Pereloma[a,b*]

[a]School of Mechanical, Materials and Mechatronics Engineering, University of Wollongong, Wollongong 2522, Australia

[b]UOW Electron Microscopy Centre, University of Wollongong, Wollongong 2522, Australia

pm999@uowmail.edu.au

elenap@uow.edu.au

[*]Corresponding author. Parvez Mannan, Tel.: +8801754321780, +8801997524920

[*]Corresponding author. Elena V. Pereloma Tel.: +61 2 4221 5507, fax: +61 2 4298 5731

Abstract

Dynamic and metadynamic recrystallisation behaviour of Ni-30Fe-Nb-C model alloys during plane strain compression was investigated by optical and electron microscopy. The dynamically recrystallised grains were primarily located at the pre-existing grain boundaries with few additional new recrystallised grains in the prior grain interior. A limited nucleation of recrystallised grains at >400 nm size NbC particles was also evident. On the other hand, smaller semi-coherent particles (~10-150 nm) severely inhibit the dislocations rearrangement and subgrain boundary mobility, thus leading to sluggish or even suppressed dynamic and metadynamic recrystallisation. These smaller NbC particles maintained cube-on-cube orientation relationship with austenite matrix $(001)_{\mathrm{NbC}} || (001)_{\gamma}$, $[001]_{\mathrm{NbC}} || [001]_{\gamma}$. The shape of the NbC particles changes from nearly ellipsoidal to octahedral followed by hexagonal and tetra-kai-decahedral by truncation of {111} facets by {001} ones.

Keywords: Dynamic recrystallisation, Metadynamic recrystallisation, Particle stimulated nucleation, Precipitation, Model alloy, Plane strain compression.

[1] Present address: Department of Materials Science and Engineering, Khulna University of Engineering and Technology, Khulna 9203, Bangladesh