Accepted Manuscript

Effect of kinematic stability of the austenite phase on phase transformation behavior and deformation heterogeneity in duplex stainless steel using the crystal plasticity finite element method

Eun-Young Kim, WanChuck Woo, Yoon-Uk Huh, BaekSeok Seong, JeomYong Choi, Shi-Hoon Choi

PII: S0749-6419(15)00208-9

DOI: 10.1016/j.ijplas.2015.12.009

Reference: INTPLA 1999

To appear in: *International Journal of Plasticity*

Received Date: 7 August 2015

Revised Date: 11 December 2015

Accepted Date: 12 December 2015

Please cite this article as: Kim, E.-Y., Woo, W., Huh, Y.-U., Seong, B., Choi, J., Choi, S.-H., Effect of kinematic stability of the austenite phase on phase transformation behavior and deformation heterogeneity in duplex stainless steel using the crystal plasticity finite element method, *International Journal of Plasticity* (2016), doi: 10.1016/j.ijplas.2015.12.009.

Effect of kinematic stability of the austenite phase on phase transformation behavior and deformation heterogeneity in duplex stainless steel using the crystal plasticity finite element method

Eun-Young Kim[1], WanChuck Woo[2], Yoon-Uk Huh[3], BaekSeok Seong[2], JeomYong Choi[4] and Shi-Hoon Choi[1*]

[1] Department of Printed Electronics Engineering, Sunchon National University, 315 Maegok, Sunchon, Jeonnam 540-950, Republic of Korea

[2] Neutron Science Division, Korea Atomic Energy Research Institute, Daejeon, 305-535, Republic of Korea

[3] Graduate Institute of Ferrous Technology, POSTECH, Pohang, 790-784, Republic of Korea

[4] POSCO Technical Research Laboratories, Pohang 790-785, Republic of Korea

Abstract

The crystal plasticity finite element method (CPFEM) was applied to determine the influence that the kinematic stability of the austenite (γ) phase exerts on the phase-transformation behavior and deformation heterogeneity of duplex stainless steel (DSS) showing γ to martensite (α′) transformation during uniaxial tension. A phase-transformation model was implemented in the CPFEM to consider the effect of transformation-induced plasticity (TRIP) on micromechanical behaviors in DSS. The individual flow curves of the ferrite (α), γ and α′ phases in DSS were determined via *in-situ* neutron diffraction in combination with the CPFEM. The effect of the kinematic stability of the γ phase on phase-transformation behavior and deformation heterogeneity in DSS during uniaxial tension was demonstrated using the CPFEM based on the representative volume elements (RVEs) of a unit cell for DSS.

Keywords: Neutron diffraction; Duplex stainless steel; Phase transformation; Crystal plasticity; Kinematic stability