Accepted Manuscript

A study of microstructural evolution of Fe-18Cr-8Ni, Fe-17Cr-12Ni, and Fe-20Cr-25Ni stainless steels after mechanical alloying and annealing

Hasan Kotan, Kris A. Darling

PII: S1044-5803(17)33420-4
DOI: https://doi.org/10.1016/j.matchar.2018.02.001
Reference: MTL 9045

To appear in: *Materials Characterization*

Received date: 6 December 2017
Revised date: 31 January 2018
Accepted date: 1 February 2018

Please cite this article as: Hasan Kotan, Kris A. Darling , A study of microstructural evolution of Fe-18Cr-8Ni, Fe-17Cr-12Ni, and Fe-20Cr-25Ni stainless steels after mechanical alloying and annealing. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Mtl(2017), https://doi.org/10.1016/j.matchar.2018.02.001

A study of microstructural evolution of Fe-18Cr-8Ni, Fe-17Cr-12Ni, and Fe-20Cr-25Ni stainless steels after mechanical alloying and annealing

Hasan Kotan[1], Kris A. Darling[2]

[1]Konya Necmettin Erbakan University, Department of Metallurgical & Materials Engineering, Konya, 42090, Turkey

[2]U.S. Army Research Laboratory, Weapons and Materials Research Directorate, RDRL-WMM-F, Aberdeen Proving Ground, MD 21005-5069, USA

Corresponding Author: Phone number: + 90 332 325 2024 – 4056, e-mail: hasankotan@gmail.com

Abstract

In this study, high-energy mechanical alloying technique was used to produce nanocrystalline stainless steels of three different compositions from elemental powders. The microstructural evolution (grain growth and phase transformation) as a function of alloy compositions and annealing temperatures were investigated by room and high temperature x-ray diffraction experiments, transmission electron microscopy and focused ion beam microscopy. The results revealed that stainless steels with low nickel content (i.e., Fe-18Cr-8Ni) underwent a deformation-induced martensitic transformation during room temperature mechanical alloying. Deformation-induced martensitic transformation with increasing nickel content (i.e., Fe-17Cr-12Ni and Fe-20Cr-25Ni) would not be possible by room temperature milling but was created by high strain rate cryogenic processing, the degree to which was compositional dependent. Post process annealing induced the reverse transformation from martensite-to-austenite the ratio of which was found to be a factor of alloy composition and annealing temperature. The real time in-situ x-ray studies showed that the martensite-to-austenite reverse transformation was