URN etd-0407109-183721-1739
Author I-jen Kuo
Author's Email Address No Public.
Statistics This thesis had been viewed 55 times. Download 247 times.
Department
Year 2006
Semester 1
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Phase transformations in an Fe-15Mn-8Al-10Co Alloy
Date of Defense 0000-00-00
Page Count 105

Keyword
Fe and Mn and Al
Fe-Mn-Al

Abstract
The purpose of the present study is an attempt to examine the microstructural changes and phase transformations of an Fe-15Mn-8Al-10Co alloy by means of transmission electron microscopy (TEM). The effects of the lower Mn additions on the microstructure of the Fe-28Mn-8Al-10Co alloy are also investigated.
Based on our experimental examinations, some results were obtained. (1) In the as-quenched condition, the microstructure of the Fe-15Mn-8Al-10Co alloy was the single ferrite phase. TEM examinations revealed that (B2+D03) ordered phases could be found within the ferrite matrix. Based on the analyses of dark-field electron micrographs, it was concluded that B2 and D03 ordered phases were formed during the rapid quenching process by the continuous ordering transition. (2) When the Fe-28Mn-8Al-10Co alloy was aged at temperatures ranging from 450℃ to 750℃, the ordering phase transformation sequence occurring within the ferrite region was found to be (α+D03)→(α+B2)→(α+B2*)→(α+B2+B2*)→(α+B2)→α. (3) When the alloy was aged at 550℃ for various times, B2* ordered particles precipitated within the (α+B2) region by nucleation and growth mechanism. Along with the growth of B2* ordered particles, the phase transition sequence of (α+B2)→(α+B2+B2*)→(α+B2*) could be observed. When the alloy was aged at 550℃ for 168 hours, austenite and L12-type precipitates were observed within the (α+B2*) matrix. This particular L12-type precipitates has never been reported by other workers in the phase transformations of Fe-Mn-Al alloys before. (4) When the alloy was aged at 700℃ for 24 hours, plate-like austenite precipitates began to appear within the ferrite matrix. The Al and Co contents of the ferrite phase adjacent to the austenite precipitates increased with the growth of the austenite precipitates. Therefore , two different stable microstructures B2 and (α+B2) could be observed within the ferrite matrix simultaneously. This result has also nerer been reported before. (5) The decrease in the Mn content of the Fe-28Mn-8Al-10Co alloy not only lowered the B2→D03 and α→B2 transition temperature but also expanded the existing temperature range of B2* ordered phase.
Keywords: Fe-Mn-Al-Co Alloy, TEM, B2 and D03 ordered phases, Continuous Ordering Transformations, Nucleation & Growth Mechanism
Advisory Committee - advisor

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Date of Submission 2007-08-08