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Abstract
The purpose of the present study is an attempt to examine the effects of Carbon additions on the microstructural changes and phase transformations of Fe-28Mn-8Al-10Co-(0.5,2)C alloys by means of optical microscopy, transmission electron microscopy and energy-dispersive X-ray spectrometry. Based on our TEM examinations, it was concluded as belows : (1) In the as-quenched condition, the microstructure of the Fe-28Mn-8Al-10Co-0.5C alloy was the mixture of ferrite and austenite phases. TEM examinations revealed that no (Fe,Mn)3AlCX carbides precipitated within the austenite matrix, however, find (B2+DO3) phases could be found within the ferrite region. When the alloy was aged at temperatures ranging from 450 to 750℃, the phase transformation sequence of α→α＋B2→B2＋DO3→DO3 pccurred within the ferrite region. When the alloy was aged at 650℃, the phase decomposition sequence of γ→(γ＋B2) occurred on the γ/γ grain boundary. TEM examinations revealed that no (Fe,Mn)3AlCX carbides could be observed within the austenite matrix. This result indicated that the lower carbon contents in Fe-Mn-Al-Co-C alloys inhibited the precipitation of (Fe,Mn)3AlCX carbides within the austenite matrix and also enhanced the formation of (B2+DO3) ordered phases within the ferrite region. This result was quite different than those observed in the Fe-Mn-Al-C alloy system before. (2) In the as-quenched condition, the microstructure of the Fe-28Mn-8Al-10Co-2C alloy consisted of a single austenite phase. Extremely fine (Fe,Mn)3AlCX carbides with cubic morphology precipitated coherently within the austenite matrix of the as-quench Fe-28Mn-8Al-10Co-2C alloy. The particle sizes of the (Fe,Mn)3AlCX carbides ranged from 15 to 20 nm in diameter. When the alloy was aged at 550℃ forvarious times, (Fe,Mn)3AlCX carbides grew obviously at austenite matrix and the phase transformation of γ→（γ＋κ'）occurred on the austenite grain boundary. The hardness value was measured to be about HRC46.7, which is attributed to the strengthening effects of fine (Fe,Mn)3AlCX carbides with cubic morphology precipitated coherently within the austenite matrix. When the aging time period was prolonged to 48 hours or above, the hardness value dropped gradually and the (Fe,Mn)3AlCX carbides on the austenite grain boundary grew rapidly towards the adjacent austenite matrix. When the alloy was aged at 750℃, coarse (Fe,Mn)3AlCX carbides precipitated rapidly on the austenite grain boundaries and the phase decomposition of γ→（γ＋κ'）occurred. The obove results indicated that the inoreasing of carbon contents enhanced the precipitation of (Fe,Mn)3AlCX carbides within the austenite matrix and on the grain boundaries. The formation of β-Mn and DO3 phase was inhibited in the Fe-28Mn-8Al-10Co-2C alloy. This result has also never been reported by other workers in the Fe-Mn-Al-Co-C alloy system before.
Advisory Committee Wu Chung-Chun - advisor

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