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Abstract
The purpose of the present study is an attempt to examine the effects of cryogenic treatments on microstructures and mechanical properties of the dual-phase Fe-15Mn -8Al-10Co-1C Alloy by means of optical microscopy (OM), hardness(HRC) tester, wear resistance tester, X-ray diffraction Spectrometry(XRD) and transmission electron microscopy (TEM).

Based on our TEM examinations, it was concluded as bellows: (1) When the Fe-15Mn-8Al-10Co-1C alloy was solution treated and aged for a longer time period, the hardness and wear resistance of the alloy was better than that of the alloy aged for a shorter time period. It was also found that the cryogenic treatment could promote the surface hardness and wear resistance of the alloy significantly. (2) When the alloy was cryogenic treated and aged at 450℃ for 72 hours, D03 ordered phase grew within the (α+B2) region and the stable microstructure of (α+D03) could be observed. However, when the cryogenic treatment was performed behind the aging treatment at 450℃ for 72 hours, (α+B2*) could be observed within the ferrite region. The domain size of B2* ordered phase was similar to that of D03 ordered phase, indicating that the D03 → B2* transition was occurred during the cryogenic treatment of the alloy. It was concluded that the ordering transformation sequence of (α＋B2+D03)→(α+B2*) occurred within the ferrite region. The above result has never been found by other researchers in the Fe-Mn-Al-C alloys before. (3) When the alloy was cryogenic treated and then aged at 550℃, B2* particles precipitated and grew rapidly within the ferrite region. Along with the growth of ordered Co-enriched and Al-enriched B2* particles, the Mn and C concentrations near by ordered B2 particles became higher than the ferrite matrix, resulting the precipitation of the plate-like (Fe,Mn)3AlCX carbides within the (α+B2*) region. (4) The cryogenic treatments could not promote the phase transformation of austenite to martensite phases within the Fe-15Mn-8Al- 10Co-1C alloy, however the cryogenic treatment could improved the mechanical properties of the alloy, especially improved the wear resistance property.
Keyword: Cryogenic treatments, Fe-Mn-Al-Co-C alloy, dual phases Microstructure, B2 and D03 ordered phases, phase transformation, martensite, (Fe,Mn)3AlCX carbides, surface hardness, wear

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