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Abstract
Owing to the excellent corrosive and abrasive resistance, Fe-Mn-Al alloys have been developed at some industrial applications, such as steel molds, golf clubs, etc. Based on experimental results, the corrosive resistance of Fe-Mn-Al alloys was superior to that of conventional steels of molds, indicating that Fe-Mn-Al alloys have great potentiality for some specific applications.

In the present research, the effects of Co addition on the phase transformation of the Fe-Mn-Al alloy have been investigated by means of transmission electron microscopy. In the as-quenched condition, the microstructure of the Fe-Mn-Al-Co alloy was the mixture of α (ferrite) + γ (austenite) phases. When the Fe-28Mn-8Al-5Co alloy was aged at various temperatures ranging from 450℃ to 750℃ for moderate times, no precipitates could be detected within the austenite phase. However, the phase transformation sequence of (α + DO3) → (α + DO3 + α-Mn) → (α + B2 + γ) → (α + γ) → α occurred within the ferrite region. No β-Mn precipitates could be observed in the Fe-Mn-Al-Co alloy, indicating that the Co addition in the Fe-Mn-Al alloy inhibited the precipitation of the β-Mn phase. This result has never been reported by other workers in the Fe-Mn-Al alloy system before.

The hardness and corrosion properties of the Fe-Mn-Al-Co alloy changed with different aging temperatures. Based on our TEM observations, some results were given below: (1)After being aged at 550℃ for 24 hours, the Fe-Mn-Al-Co alloy with a higher Co content could achieve a maximum hardness value. (2)When the aging temperature was increased to 600℃ or above, the hardness property of the Fe-Mn-Al-Co alloy decreased significantly. (3)It is well-known that the formation of β-Mn phase resulted in the embrittlement of the Fe-Mn-Al alloy. In the present study, no evidence of β-Mn precipitates could be detected within the ferrite matrix in the present alloy after being aged at temperatures ranging from 450℃ to 750℃. This is the reason why the Fe-Mn-Al-Co alloy can achieve an outstanding combination of hardness and toughness. This result has never been reported in the Fe-Mn-Al alloy system before. (4)The corrosive resistance of the Fe-Mn-Al-Co alloy decreased slightly with increasing the aging temperatures.
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