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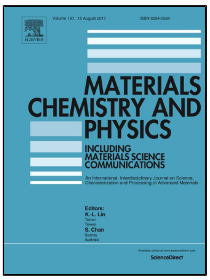

Effect of C content on microstructure and tensile properties of as-cast CoCrFeMnNi high entropy alloy

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Effect of C content on microstructure and tensile properties of as-cast CoCrFeMnNi high entropy alloy

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Abstract: The as-cast $CoCrFeNiMnC_x$ (x=0, 0.05, 0.1, 1.5 and 2.0) alloys were prepared in a vacuum arc furnace. The microstructure and phase constituents were characterized by scanning electron microscopy, X-ray diffraction and transmission electron microscopy, and the tensile properties were tested as well. The results show that the CoCrFeNiMn and $CoCrFeNiMnC_{0.05}$ alloys have a single phase FCC structure. When the carbon concentration is beyond 0.1 (x=0.1, 1.5 and 2.0), the M_7C_3 carbide generates in the interdendritic regions and at the grain boundaries. Minor C addition can trigger a transition from dislocation glide dominated plasticity to a mixed deformation mode consisting of dislocation glide and twining, which increases the strength and ductility of the $CoCrFeNiMnC_{0.05}$ alloy compared with the CoCrFeNiMn alloy. The $CoCrFeNiMnC_{0.05}$ and $CoCrFeNiMnC_{0.1}$ alloys have a typical lamellar pattern on the fracture surface due to the formation of columnar grains and the segregation of C at the grain boundaries. The alloys become stronger with the increase of carbon concentration, but at $x > 0.1$, the ductility decreases and the $CoCrFeNiMnC_{0.15}$ and $CoCrFeNiMnC_{0.2}$ alloys present a quasi-cleavage fracture mode.

Key Words: High entropy alloy; C concentration; Tensile properties; Deformation twins

1. Introduction

High entropy alloys (HEAs) have been paid great attentions in past decades [1–12]. The