Influences of Replacing Cr with Mo in $Fe_{25}Co_{25}Ni_{25}Cr_{25-X}Mo_X$ HEA Series on the Microstructure and Mechanical Properties

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Abstract

$Fe_{25}Co_{25}Ni_{25}Cr_{25-X}Mo_X$ HEAs were fabricated in mini arc-melter and then cast into 4mm diameter cylinders by injection casting technique and 1cm diameter cylinders by water quenching technique. Heat transfer modeling during solidification of FeCoNiCr HEA was simulated. Combining XRD, OM, SEM, EDX, microhardness tests and compression tests, the influences of replacing Cr with Mo in $Fe_{25}Co_{25}Ni_{25}Cr_{25-X}Mo_X$ HEA series on the microstructure and mechanical properties were investigated. $Fe_{25}Co_{25}Ni_{25}Cr_{25-X}Mo_X$ HEAs with $X \geq 10$ produce σ phase after annealed at 800℃ for 2h. HEAs with $X < 9$ remain single FCC solid solution phase after annealing at 800℃ for up to 24h. $Fe_{25}Co_{25}Ni_{25}Cr_{16}Mo_9$ HEA shows a compression strength of ~1.4GPa and fracture strain >0.8. Fe25Co25Ni25Mo25 has an ultimate compressive strength of ~1.7GPa and fracture strain of 0.24.

Thursday, July 26, 2018

10:00 AM, Rogers 226

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