# The effect of boron content on the microstructure and mechanical properties of Fe 50-X Mn 30 Co 10 Cr 10 B X (x?=?0, 0.3, 0.6 and 1.7?wt%) multi-component alloys prepared by arc-melting

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High and Medium- Entropy Alloys (HEAs and MEAs) are a novel type of materials, which due to the reduction in configurational entropy, can offer an excellent combination of properties, such as, high strength, high ductility and moderate hardness. During the study, four alloys based on Fe 50-X Mn 30 Co 10 Cr 10 B X system (x = 0, 0.3, 0.6 and 1.7 wt%) were manufactured by arc melting. The microstructure of the materials was analyzed by optical microscopy, scanning electron microscopy, and X-ray diffraction. The Vickers microhardness of these alloys were also measured. Detailed characterization revealed the formation of a dual-phase matrix (fcc + hcp) due to the reduction in the stability of the fcc phase that led to a thermal induced partial martensitic transformation into a ?-hcp phase. The addition of boron promoted the formation of M 2 B-type borides (M = Cr, Fe), whose content increased with the addition of B. Changes in the phase composition, specifically the decrease of the hcp phase, were mainly due to the loss of manganese content. The microstrain analysis showed the absence of residual stresses in the crystal lattice due to a decrease in the dislocation's density after the martensitic transformation. When boron content was brought from 0 wt% to 1.7 wt%, the microhardness of the material increased from 296HV to 452 HV, which is comparable to the microhardness of high-manganese steel. Finally, the thermodynamic parameter ? was calculated using a phase prediction package AlloyASAP, allowing to establish that boron addition to Fe 50 Mn 30 Co 10 Cr 10 originated medium-entropy alloys (? < 1), while the absence of boron give a high-entropy alloy (? > 1).