Investigation of phase transitions in as-cast FeNiCo alloys

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FeNiCo system is very interesting because it provides soft magnetic materials with high magnetic saturation and Curie temperature variable with the composition of Ni and Co, and, in principle, it presents a first-order magnetic transition [1]. These properties are dependent on the alloy composition, heat treatment and material scale. The correct tuning of these properties can improve the efficiency of thermomagnetic motors, which are efficient alternatives to convert thermal energy [2]. In this work, the phase transitions in the Fe-24.5%at.Ni-10%at.Co; Fe-22.5%at.Ni-10%at.Co; Fe-22.5%at.Ni-12%at.Co; Fe-26.5%at.Ni-10%at.Co and Fe-26.5%at.Ni-8%at.Co alloys were studied using X-ray diffraction patterns, optical microscopy, microhardness measurements, scanning electron microscopy, differential scanning calorimetry, magnetization measurements as function of temperature and applied field. The purpose of this work is to investigate the alloy in the composition of the predicted first order transition at 573 K and its surroundings, evaluating the phases formed after the solidification and fast cooling of the alloy [3]. The results show that a solid solution is formed at room temperature in all the as-cast alloys. This solid solution is ordered after heating to form a dendritic Fe-rich phase with significant increase in microhardness. The reaction temperatures are dependent on the concentration of Ni and Co, and the magnetic transition was measured.

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