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Effects of Ti content on the phase composition of multi-principal elements CuFeMnNiSnTi alloys

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Multi-principal elements (MPE) alloys have been considered a promising materials class, which will provide fundamental advanced applications. This understanding is attached to several unique properties, including high hardness, damage tolerance, high thermal stability, and good wear resistance. Liu et al. (2012) [1] studied the tin role in the magnetic properties of the MPE CuFeMnNiSnTi alloy, whose ferromagnetic behavior was attributed to the Ti(Fe, Ni)2Sn presence. Considering that changes in Ti content of the CuFeMnNiSnTi alloy may strongly affect its magnetic behavior, in this study the CuFeMnNiSnTix (x is between 0 and 1) alloys were characterized using optical microscopy, scanning electron microscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction, and curves of magnetization as a function of the applied field. The phase composition in the CuFeMnNiSnTi alloy was estimated using Rietveld Refinement from X-ray diffraction patterns, whose results indicated the presence of (Fe, Mn)2Ti, Ti(Fe, Ni)2Sn, and (Cu, Mn, Ni)3Sn phases. The (Cu, Mn, Ni)3Sn phase fraction increased when the Ti content was reduced, and in the CuFeMnNiSn alloy the (Cu, Mn, Ni)3Sn, (Fe)bcc, and (Fe)fcc phases were found. Even though Liu et al. (2012) attributed the ferromagnetic behavior to the Ti(Fe, Ni)2Sn phase, the saturation magnetization of the CuFeMnNiSn alloy was almost three times higher than that found in the CuFeMnNiSnTi alloy. [1] L. Liu, J.B. Zhu, J.C. Li, Q. Jiang, Microstructure and magnetic properties of FeNiCuMnTiSnx high entropy alloys, Advanced Engineering Materials. 14 (2012) 919–922. https://doi.org/10.1002/adem.201200104.