

**Processing of FeNiCrCuZn, FeNiCrCuZn(Nb)_{0,5}, FeNiCrCuZnNb High Entropy Alloys
by Mechanical Alloying and Spark Plasma Sintering**
A. Bepe^{1,*}, K. Cardoso¹

¹ Laboratory of Metallic Materials, Federal University of São Paulo, São José dos Campos 12231280, Brasil

*Corresponding author: andrebepe@gmail.com

The present research reports a new approach for alloy designing. Since 1995 systems with multiprincipal elements have been explored. This new class of alloys referred to as "high-entropy" alloys (HEAs) are designed based on selecting elements that will form solid solution phases when combined at near-equiatomic concentrations. HEAs are advanced materials with unique and promising properties depending on the composition or the processing route applied in its production. In this study the selected alloys FeNiCrCuZn, FeNiCrCuZn(Nb)_{0,5} and FeNiCrCuZnNb were produced by mechanical alloying followed by Spark Plasma Sintering. The microstructural characterization of both the as-milled powder and the sintered alloy was carried out using scanning electron microscopy (SEM), transmission electron microscopy (TEM) and x-ray diffraction (XRD). After 40 hours of milling, the crystalline structure of the FeNiCrCuZn alloy consists of a face-centered cubic solid solution with lattice parameter of 3,66Å. Whereas, Nb addition induced partial amorphization of the crystalline structure of both FeNiCrCuZnNb and FeNiCrCuZn(Nb)_{0,5} alloys. The thermal stability of these alloys was analysed by differential scanning calorimetry (DSC) and differential thermal analysis (DTA), the results show that the three alloys are stable in temperatures up to 570°C. Vickers microhardness analysis indicate that the FeNiCrCuZn alloy has an average hardness of 543HV while Nb addition further hardened the FeNiCrCuZn(Nb)_{0,5} and FeNiCrCuZnNb alloys to 605 and 655HV respectively.

Acknowledgements:

CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior)
CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) Process Number:
446716/2014-6
ITA-IEAv (Instituto Técnico Aeroespacial – Instituto de Estudos Avançados)
UFSCAR (Federal University of São Carlos)
INPE (Instituto Nacional de Pesquisas Espaciais)