Processing of FeNiCuCrZn, FeNiCuCr$_{0,5}$Zn, FeNiCuCr$_{0,2}$Zn High Entropy Alloys by Mechanical Alloying and Spark Plasma Sintering

V. Almeida[1], A.M. Bepe[1], K.R. Cardoso[1]

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

·Corresponding author: viniciuspiresalmeida7@gmail.com

This research refers to the study of a novel class of metal alloys. This innovative field of study refers to multi-element based alloys classified as "high-entropy" alloys (HEAs), composed by at least five or more components, in which the atomic concentration of each element may vary from 5% up to 35%. HEAs are advanced materials that are currently on the focus of significant attention in materials science and engineering due to their promising properties depending on the composition and/or processing route applied in its production. The selected alloys FeNiCuCrZn, FeNiCuCr$_{0,5}$Zn, FeNiCuCr$_{0,2}$Zn were produced by mechanical alloying followed by Spark Plasma Sintering. As-milled and sintered samples were characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM) and x-ray diffraction (XRD).Mechanically alloyed powder after 40h presented a nanocrystalline structure composed by a face centered cubic solid solution with lattice parameter of 3,66Å and residual Cr. The effects of reducing Cr contend was limited to decrease the quantity of this Cr residual phase. Differential scanning calorimetry (DSC) showed that the alloys are stable in temperatures up to 570ºC. The Vickers microhardness test indicates an average hardness of 543 HV for the equimolar alloy.