Development and Characterization of AlAgNbTiZn High Entropy Alloy

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High entropy alloys (HEAs) are considered as a new class of alloys and have attracted attention from the scientific community [1]. These alloys are employed in the aerospace and automotive industries due to their high mechanical properties at room temperature and at high temperature, since the materials in these industries are in constant friction, which leads to an increase in the working temperature [1]. In addition, these alloys have a high corrosion resistance, due to the high entropy, which causes less diffusion, reducing the corrosion rate of these [2]. The HEAs consist of at least five different elements in equiatomic proportions, seeking the formation of a solid solution [3]. In this work the AlAgNbTiZn alloy was first analysed in order to verify its mechanical properties and to study the compatibility of the crystalline structures. The alloy was produced through powder metallurgy and various heat treatment were carried out at temperature of 580 °C and 750 °C, from 1 to 24 hours. The X-ray diffraction (XRD) technique showed the formation of $TiZn_3$ phase, NbTi and AgAl solid solution phases to samples heat treatment at 580 °C. Samples heat treatment at 750 °C for 24 hours shows a complete solid solution.

The mechanical properties were explored to all samples. The highest limit of compressive was obtained for the alloy heat treat at 750 ºC for 24 hours with 520 ± 10 MPa. The specific density measurement shows a high porosity with 85 ± 1 % of mean densification. Due to high porosity a low limit of compressive is observed when it is compared to HEAs alloys manufacturing by arc melting.

References:

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