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CORRELATION BETWEEN MECHANICAL PROPERTIES AND MICROSTRUCTURE OF THE NANOCOMPOSITES OF AL7075 AND SILVER NANOPARTICLES

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The current demand for stronger and lighter materials has allowed the generation of new materials that combine high resistance with low densities, an example of these materials are nanocomposites, which are obtained by combining one or more materials with sizes around of nanometers into a bulk material, this nanocomposites gives properties different from those presented individually. Nanocomposites of Al alloy 7075 were produced by introducing into the matrix a second phase particles of nanometer size by the technique of powder metallurgy to increase their mechanical properties. The dispersion of silver nanoparticles coated with carbon (Ag-C NP) within the matrix of 7075 aluminum (Al7075) was performed by mechanical milling in a SPEX mill of high energy milling for different times (5 and 10 h), powders were compacted under uniaxial compression at 950 MPa to obtain a pellet of 4 cm in diameter, sinterized in an argon atmosphere for 24 h and finally indirect hot extrusion at 773 K with a dice with circular aperture and a ratio of 25:1 allowed to produce bars of 1 cm in diameter and about 50 cm long.

Yield stress (σ_o) and ultimate tensile strength (σ_{max}) gradually increases as the nanoparticle content is increased, as well as when the milling time increases. As the nanoparticle content increases stress increase, reaching a maximum value at 1.5% of silver nanoparticles. Content that presents a similar value of stress for both times of milling. All nanocomposites have increases greater than 100% in the yielding stress and 45% for the ultimate tensile stress with respect to the Al 7075 alloy in annealed state [1]. Morphology of the Al 7075 alloy is formed by a matrix rich in aluminum and different particles rich in copper, zinc and magnesium, mainly, distributed throughout the matrix. With the addition of nanoparticles, the morphology

shows a homogeneous distribution of silver nanoparticles in the matrix of aluminum. This homogeneous distribution of nanoparticles is one of the main mechanisms of the strengthening of the alloy.

[1] MatWeb, Online Materials Property Data. http://www.matweb.com