Corrosion Resistance of Ultrafine – Grained Aluminum Alloys Obtained Through Severe Plastic Deformation

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There are several processes of severe plastic deformation (SPD) in which a very large plastic strain is imposed in a metallic sample, in order to reduce the grain size to the sub-micrometric scale (<1μm). These processes not only modify the mechanical properties of the metal, but can also have influence in other properties like electrical, optical, magnetic and corrosion resistance. In the present work, an Al AA1050 alloy will be processed by equal-channel angular pressing (ECAP), up to 8 passes in a die with intersecting angle of 120˚, which means an equivalent strain equal to 5.4. A series of tests will be performed to evaluate the effect of the number of ECAP passes on the corrosion resistance of the material. To evaluate the intergranular corrosion behavior of the ECAPed samples, immersion tests will be carried out in a solution containing NaCl plus H_2O_2. Pitting potentials will be determined by means of polarization curves in NaCl solutions. Both the microstructural modifications and the morphology of corrosion attack will be investigated by optical microscopy (OM), scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS). It is expected that the corrosion behavior of the Al AA1050 alloy may be improved through ECAP processing. Recent studies have showed that the intergranular corrosion behavior of Al alloys is improved with grain refinement provided by ECAP due to the break in continuity of grain boundary. In addition, the residual stress, strain induced crystalline defects and non-equilibrium grain boundaries from ECAP process appear to provide more nucleation sites for the formation of a denser and thicker Al oxide layer, which enhances the pitting corrosion resistance.