Synthesis of Nanocrystalline Zirconium-rich alloys with high Glass Forming Ability

Amanda V. Castilho[1*#], Dilson S. dos Santos[1]

[1]Laboratory of Mechanical Properties, Department of Metallurgy and Materials, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

[#]Corresponding author: amandaventura@metalmat.ufrj.br

Nanocrystalline alloys present high grain-boundary volumetric fraction and show some different properties if compared with conventional alloys, such as: high corrosion resistance [1] and high interstitial and substitutional elements diffusivity [2]. These materials have strong industrial applications, like coatings with high corrosion resistance and Hydrogen storage alloys. In this work Thermodynamic Simulations were performed to select the studied compositions. "Suction Casting" method was used to obtain three high Glass Forming Ability compositions, $Cu_{42}Zr_{42}Al_8Ag_8$ [3], $Cu_{42}Zr_{42}Al_8Ag_4Sn_4$ and $Cu_{42}Zr_{42}Al_8Sn_8$, with nanoscale grain size. X-Ray Diffraction and Scanning Electron Microscope characterizations confirmed the microstructure refinement after non-equilibrium solidifications. Differential Scanning Calorimetry assays were also performed and show expected recrystallization phenomena. Polarization Curves results do not show substantial corrosion potential difference between the conventional and nanocrystalline alloys. To investigate the Hydrogen interaction with the samples, Thermal Dessorption Spectroscopy experiments were realized and results suggests that the "Suction Casting" process lead to structures where the Hydrogen is more weakly bonded.

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