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RESEARCH AND DEVELOPMENT OF THE SINTESYS OF U-5%Zr-3,5%Nb ALLOYS BY PLASMA MELTING

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ABSTRACT

Uranium both natural and enriched form, is the most common fuel, both as regards availability and use. It can be employed in the form of pure metal, as a constituent of an alloy, as the oxide, carbide, or other suitable compound. Metallic uranium is used as the fuel in most of the research and propulsion nuclear reactors, largely because it provides the maximum number of uranium atoms per unit volume. However, because of its poor mechanical properties and great susceptibility to radiation damage, the use of uranium is generally associated to others metallic elements, as uranium alloys.

Is possible to use some uranium alloys as nuclear fuels if a good performance under irradiation be observed, specifically the corrosion resistance and the dimensional stability must be subject of special attention. In this context, two general concepts are employed: (1) to dissolve relatively small parts of a suitable metal, such as chromium, molybdenum, niobium, or zirconium, in the uranium to stabilize the gamma phase to improve the dimensional stability, and (2) to use metals with good stability under irradiation and good corrosion resistance as a protective cladding, as zirconium alloys and aluminium alloys.

To investigate the possible use of uranium alloys as a high density nuclear fuel, the CTMSP have done some effort to investigate synthesis of the metallic system U-Zr-Nb to the naval propulsion. The present work has by objective to understand the metallurgic synthesis by melting of the U-Zr-Nb alloy in a plasma furnace, as well as the microstructure and homogeneity of the obtained samples.

The technological goal of the present work was the synthesis of the U-5%Zr-3,5%Nb alloy with high homogeneity, looking for the optimization the refining of the microstructure, because in the earlier experiments the niobium element was of very difficult melting, generating heterogeneous samples in the ternary alloy.

To solve this homogeneity problem, were pressed some samples using Nb and Zr powders and these samples were melted with metallic uranium parts to produce the ternary alloy U-Zr-Nb in a first melting in a Laboratory Plasma Furnace.

The microstructural homogeneity of the binary and ternary alloys was observed by microstructural characterization by Polarized optical microscopy and Scanning Electron Microscopy (SEM), and X Ray Diffraction.