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# Surface Modification of UMo Particles by Atomization under Reactive Atmosphere

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## ABSTRACT

Generally, the atomization of UMo particles occurs under vacuum or argon atmosphere, and the modification of the surface of these UMo particles is, usually, carried on through a further process. The techniques for surface modification of atomized UMo particles, aimed to control the Fuel/Matrix interaction, involve, in some cases, complicated methodologies and often with minor effect, due to the limited solubility of third elements in solid UMo alloy. The atomization and surface conditioning, applied in separate stages, may affect the efficiency of powder production process. Then, the main objective of this study is to explore the possibilities of surface modification of UMo particles in liquid state or during the solidification that follows the centrifugal atomization operation. Through the modification of the atomization atmosphere, could be possible to promote liquid/gas reactions, with a higher solubility of the modifier element in micro drops UMo alloy, before they become solid particles.

This paper presents comparative results of centrifugal atomization of UMo particles carried out under inert atmosphere of argon and under reactive atmosphere of nitrogen. Dissolved nitrogen contents, measured by SEM-EDS analyses, reached up to 7.57 wt% at the center of under nitrogen atomized particles, very higher than 0.84 wt% of nitrogen measured at the center of UMo particle atomized under argon.

The presence of uranium nitride could not be verified in detail by conventional XRD analysis. Nevertheless, Out-of-Pile interaction test results, reveals decreasing of aluminium contents into UMo particles atomized under nitrogen atmosphere, just 3.77 wt% Al was the maximum content detected in the center of these particles, very lower than 29.11 wt% of Al measured inside UMo particles atomized under argon. Based on this preliminary study, is possible to conclude that the atomization under reactive atmosphere may modify the surface composition and the behavior of UMo fuel particles dispersed in aluminium.