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Processing and microstructural characterization of W₈Ni₃Cu metal composite

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Tungsten metal always presents a series of difficulties when it comes to obtaining a solid part for whatever object is to be applied, due to its property of high mechanical strength and high melting point, it is practically impossible to obtain a machined tungsten part. The objective of this work is to obtain a tungsten-based metal composite, i.e., using 89% of W as a support matrix, together with infiltrating elements, 8% of Ni and 3% of Cu. The processing to obtain the metallic composite (W₈Ni₃Cu) was carried out using the powder metallurgy method, where after the mass stoichiometry of each element, the powders were mixed and subjected to an isostatic pressing with a load in the order of 490 Mpa, resulting in samples in the form of tablets, with diameters in the order of 1.2 cm and atura in the order of 0.8 cm; which were then subjected to sintering processes between 1150 oC and 1350 oC. The samples were characterized using auxiliary techniques of thermal analysis (TG – DSC) and microscopy analysis (SEM – EDS). The thermal behavior of TG and DSC analyses revealed a thermal stability of the composite up to 500 °C. On the other hand, the SEM and EDS analyses showed a successful microstructural evolution despite the high sintering temperature and the affinity of W with O. A formation of binary phases involving homogeneous Ni-Cu and the ternary phase of W₈Ni₃Cu was observed, but mainly the absence of tungsten oxide formation. Therefore, with these results, it was possible to determine the sintering parameters of the samples, in order to obtain a W-based metal composite (W₈Ni₃Cu) that can be molded into different parts, and with great potential to be used in gamma radiation shielding.