MmeSi30-002

Experimental study of vanadium carbonitride (VCN) synthesis through high energy ball milling of Vanadis®8 steel scraps under a nitrogen atmosphere

Sá, K.A.S.(1); Da Rocha, L.L.(1); Dos Santos, M.C.(1); Silva, G.(1); Barbedo, E.L.(2);
(1) UNIFEI; (2) Unifei;

Transition metal carbonitrides have excellent properties in hostile environments, being the subject of studies in many applications, such as coatings, cutting tools and situations that require wear resistance. Among them, vanadium carbonitride, known as VCN, has attracted attention due to its unique properties, such as high hardness, wear resistance, high melting point, high thermal conductivity, chemical and thermal stability. In this context, several researchers have dedicated themselves to studying the development of vanadium carbonitrides (VCN) through different processing routes, such as chemical vapor deposition using organometals, self-propagating high-temperature synthesis (SHS) of vanadium carbide (VC) under a nitrogen atmosphere and high energy ball milling using graphite and vanadium powders under a nitrogen atmosphere. Based on this, this work aims to evaluate the obtaining of VCN through high energy ball milling, from Vanadis®8 steel scraps under a nitrogen atmosphere. Vanadis®8 is a type of high-value steel, characterized by the uniform presence of VC distributed in a ferritic matrix. This composition gives the material an incredible combination of wear resistance, hardness and toughness, standing out in various applications, such as tools, molds and dies. The high energy ball milling was carried out using 20 g of Vanadis®8 steel scraps under a nitrogen atmosphere in a planetary mill with a rotation speed of 350 rpm and a mass-to-ball ratio of 1:15, separating samples into intervals of 28, 38, 48 and 58 hours. For obtaining and characterizing the results of the experiment, an X-ray diffraction (XRD) analysis will be conducted to identify the phases of the samples after ball milling, as well as the Scanning Electron Microscope (SEM) will be utilized for the evaluation of morphology and particle size variation. Given the presence of VC in the composition of Vanadis®8, it is expected that VCN is formed in a nitrogen atmosphere, promoting the improvement of the material's properties, since VCN presents a superior combination of high hardness and wear resistance compared to VC.