

Microstructure and Tribological Behavior of In Situ TiC-Ni(Si,Ti) Composites Elaborated from Ni and Ti₃SiC₂ Powders

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Abstract: Herein, we study the effect of Ti₃SiC₂ on the microstructures and tribological properties of an in situ TiC reinforced Ni(Si, Ti) composites elaborated from Ni and Ti₃SiC₂ MAX phase powders against steel(100Cr6). Pressureless sintering at 1080 °C for 4 h of Ni and Ti₃SiC₂ powders was used to elaborate these composites with 10, 20 and 30 wt.% of Ti₃SiC₂. The microstructures of the composites were investigated by scanning electron microscopy (SEM), x-rays diffraction and Raman spectroscopy. Standard ball-on-disk friction wear tests under different applied loads were conducted on the composites surfaces at room temperature. For the three elaborated composites, Ti₃SiC₂ was totally decomposed and transformed to TiC phase, while the released Si and Ti atoms from Ti₃SiC₂ diffused into Ni matrix forming Ni(Si, Ti) solid solution. As compared with reference (Ni) sinter, the addition of 20 wt.% Ti₃SiC₂ in the Ni matrix improved the hardness by 250%. The addition of Ti₃SiC₂ particles also had a beneficial effect on the tribological performance of these composites against steel. The worn surfaces of the elaborated composites under all applied loads are characterized by the presence of a lubricious Fe₃O₄-αFe₂O₃ tribofilms. The effect of chemical compositions and different applied loads on the wear mechanisms of the three elaborated composites is discussed.

Keywords : In situ composites, MAX phase, Microstructures, wear