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Microstructure and Tribological Behavior of In SituTiC-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-aFe2O3 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