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Pressureless sintering and tribological properties of in-situ TiC-Ni3(Al,Ti)/Ni(Al,Ti) composites

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Abstract: In this study, we report on the microstructure and tribological characterization of in-situ TiC and ?'-Ni3(Al,Ti)reinforced ?-Ni(Al,Ti) matrix composites, synthesized by in-situ reaction of Maxthal211 (Ti2AlC-Ti3AlC2, MAX phase) and Ni precursors. Three composites were elaborated from 10, 20 and 30 wt % of the MAX phase precursor which fully reacted with Ni-matrix at 1080 °C sintering temperature for 4 h; the MAX phase decomposed into TiC, and the released Al and Ti atoms diffused in Ni matrix forming ?-Ni(Al,Ti) solid solution and ?'-Ni3(Al,Ti)intermetallic. Scanning Electron Microscopy (SEM), X-Rays Diffraction (XRD) and Raman spectroscopy were used to study the different microstructures and worn surface characteristics. Dry sliding properties of the composites under different normal loads were studied using a ball-on-disc tribometer. Addition of 10 wt % MAX phase procured the highest hardness (1.35 GPa) which is two times higher than that of pure Ni. Whereas all there inforced composites exhibited better wear resistance. The formation of a lubricious layer during sliding and the good in-situ bonding between Ni/reinforcement phases, were the main cause to the enhanced wear resistance.

Keywords : Metal matrix composites, Pressureless sintering, MAX phase, diffusion, In-situ composites, wear