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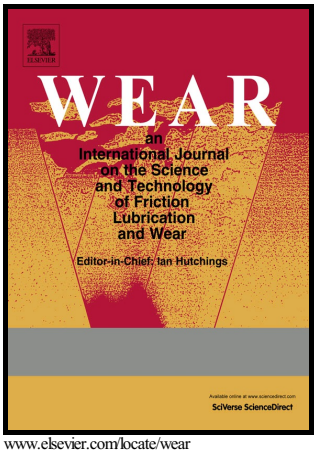

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Abstract

Despite being softer and more expensive than TiC, which is usually the preferred choice for reinforcements in a steel matrix, NbC has been shown to be a potential reinforcement for AISI 304 stainless steel matrix composites due to its favourable density with molten steels which ensures a more homogenous distribution of the second phase in the steel matrix and therefore more uniform properties throughout the casting. However, due to the solubility of NbC in the molten steel, the microstructure of the resulting steel composites present Chinese-script structures, which are not as effective in improving (and may even be detrimental to) wear performance as compared to discrete carbide particles. In this study, a unique solution is presented to the aforementioned problems; namely, by dissolving TiC in NbC, it is possible to obtain a stainless steel matrix composite reinforced with $(Nb_{0.75},Ti_{0.25})C$ which results in a higher particle hardness, a reduction in the occurrence of Chinese-script morphology, primary carbide refinement, better density matching, reduced costs, and significantly better wear resistance.

Highlights

- AISI 304 stainless steels reinforced with NbC and $(Nb_{0.75},Ti_{0.25})C$ were fabricated.
- NbC forms Chinese-script morphology that is detrimental to wear performance.
- Dissolving TiC in NbC to form $(Nb_{0.75},Ti_{0.25})C$ decreases Chinese-script morphology.
- Resulting primary $(Nb_{0.75},Ti_{0.25})C$ particles are harder, more refined and cheaper.
- $(Nb_{0.75},Ti_{0.25})C$ particles improved the wear performance of the stainless steel.

Keywords