Improving mechanical properties of metal-ceramic composites by tailoring matrix-reinforcement interface

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ABSTRACT

For material engineering, improving properties of materials is one of the main interests. Combined with low-cost approaches, it can lead to significant development of industry. Fabricating a metal matrix composite is well-known way to achieve enhanced material's mechanical properties. On the other hand, typical approach to decrease the needed volume of high-quality and high-cost functional material is to provide a coating, while the substrate can remain relatively cheap and of poor performance. Combing those two, it leaded to development of metal matrix composite coatings.

The objective of this work is to further develop metal matrix composite coating made by co-electrodeposition with nickel matrix and silicon carbide particles. Main objective is to increase wear resistance of such composite by applying protective layer onto ceramic particles. Another objective is to investigate the change introduced by such a protective layer into matrix-reinforcement interface. The first part of this work was published in [1]. Continuation is a work-in-progress with new method of protective layer fabrication as well as more focus on matrix-reinforcement interface.

Methodology involves electroless deposition of protective layer, direct-current electrodeposition, pin-on-flat wear tests, microstructural characterization and micro-beam bending.

The results show that application of protective layer indeed increases wear resistance. Additional observations include change in the mechanism of co-deposition and more homogeneous distribution of reinforcement. Special focus is put on micro-beam bending experiments where the geometry of interface plays an important role. FEM-model was applied to analyze experimental results.

It may be concluded that protective layers are a promising approach to further increasing mechanical properties of metal matrix composites.

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