INFLUENCE OF THE INTERFACIAL STRENGTH ON WEAR RESISTANCE IN NI-SIC COMPOSITE

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Wear resistance is one of the most important properties for materials. Increasing its value is of interest for both scientists and industry. One of the typical approaches is to apply anti-wear coatings on mechanically poor materials instead of the use of high-end materials, usually expensive, in bulk. Anti-wear coatings can be prepared by means of electrodeposition. However, the tribo-mechanical performance of deposited metal may not be reliable enough. To increase anti-wear properties even further, one can use co-electrodeposition in order to produce metal-matrix composite coating, such as Ni-matrix with SiC particles as reinforcement. Properties of composites are derivatives of not only matrix and reinforcement, but also their interface. If the connection is weak, it may lead to premature fracture and poor performance. Macroscopically conventional methods to measure interfacial strength are tensile and bending tests. However, one have to take into account geometry of the interface. Especially for micro-sized samples, where interface cannot be considered flat

anymore. In this work, we combined experimental and numerical methods to study interfacial strength in Ni-SiC composites and its influence on wear resistance. New experimental procedure includes FIB-milling of micro-beams with matrix-reinforcement interface, beam bending with nanoindenter until fracture and AFM scanning of fracture surface. Then, numerical approach was employed. FEM model was built based on experimental geometry of each studied micro-beam. Interfacial strength was computed. Also, macroscopic wear was measured in typical ball-on-flat geometry. The results were analyzed based on interfacial strength results. Both interfacial strength and wear resistance depend on fabrication process and method was proved useful for small-scale testing of experimental interfaces.

[1] S. Nosewicz et al. *The influence of spark plasma sintering on multiscale mechanical properties of nickel-based composite materials,* Materials Science and Engineering: A, 891, 146001, 2024

[2] P. Jenczyk et al. *Application of SiC particles coated with a protective Ni layer for production of Ni/SiC co-electrodeposited composite coatings with enhanced tribological properties*. Ceram. Int. 45, 23540–23547, 2019