

COMBINING NUMERICAL AND EXPERIMENTAL METHODS FOR INTERFACIAL BONDING STRENGTH MEASUREMENT IN MICROSCALE FOR MULTISCALE MODELING

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ABSTRACT

In materials engineering, enhancing material properties is a key area of focus. When combined with cost-effective strategies, such improvements can drive significant industrial advancements. One well-established method for achieving superior mechanical properties is the fabrication of metal matrix composites.

The aim of this study is to further advance metal matrix composites by understanding the underlying phenomena in matrix-reinforcement interface.

The initial phase of this research was published in [1] and [2], while the ongoing study explores a novel method for measuring interfacial bonding strength in Ni-SiC composites.

The proposed method combines experimental and numerical methods. First, micro-beams are prepared by Focus Ion Beam (FIB). Such beams consist of matrix and reinforcement parts as well as their interface within beam volume. Next, beams are bent until fracture. Fracture surface is scanned with Atomic Force Microscope (AFM). In the numerical part, Finite Element Method with cohesive elements is used to simulate beam bending based on experimental results (beam geometry, bending force-displacement curve, fracture surface). Finally, interfacial bonding strength is determined.

This procedure was applied for sintered as well as co-electrodeposited Ni-SiC composites. Results show that the mechanical behaviour in micro-scale is strongly influenced by fabrication route and its parameters.

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