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INTERFACIAL DEBONDING AND MECHANICAL BEHAVIOR OF PARTICLE-REINFORCED COMPOSITES

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ABSTRACT

A micromechanics-based effective elastoplastic model is proposed for particle-reinforced metal-matrix composites with particle-matrix interfacial debonding. The partially debonding process at interface is represented by the debonding angles. The equivalent orthotropic elastic moduli are constructed for the debonded yet isotropic particles to characterize the reduction of the load-transfer ability in the debonded directions. To simulate the debonding evolution and the transition between various debonding modes, the volume fractions of various particles are expressed in terms of the Weibull's statistical functions. Micromechanical homogenization procedures are utilized to estimate the effective moduli and the overall yield function of the resultant multi-phase composites. The associative plastic flow rule and isotropic hardening law are postulated based on the continuum plasticity theory. The effects of partially interfacial debonding on the overall yield surfaces and stress-strain relations of the composites are investigated and illustrated via numerical examples as well.