Investigation of Debonding Phenomena in Titanium Boride/AA4015 Metal Matrix Composites

Y. S. A. Kumar
PG Student, Department of Mechanical Engineering, JNT University, Hyderabad

Under the Guidance of Dr. A. Chennakesava Reddy, Associate Professor, JNTUH College of Engineering, JNT University, Hyderabad.

ABSTRACT

Compared with conventional materials, particle reinforced nanocomposites exhibit low density, high strength to weight ratio and high stiffness to weight ratio, high toughness with improved creep resistance and wear resistance. Combining high stiffened nanoparticles to the low modulus polymer matrix, improves the load carrying capacity. The impact of shape and size of reinforcement on the mechanical properties of composite material can be estimated through micromechanics using finite element method. Micromechanical research of the past two decades has produced a number of models of interface decohesion in heterogeneous materials such as metal matrix composites, which often represents the main source of distributed damage in composite materials.

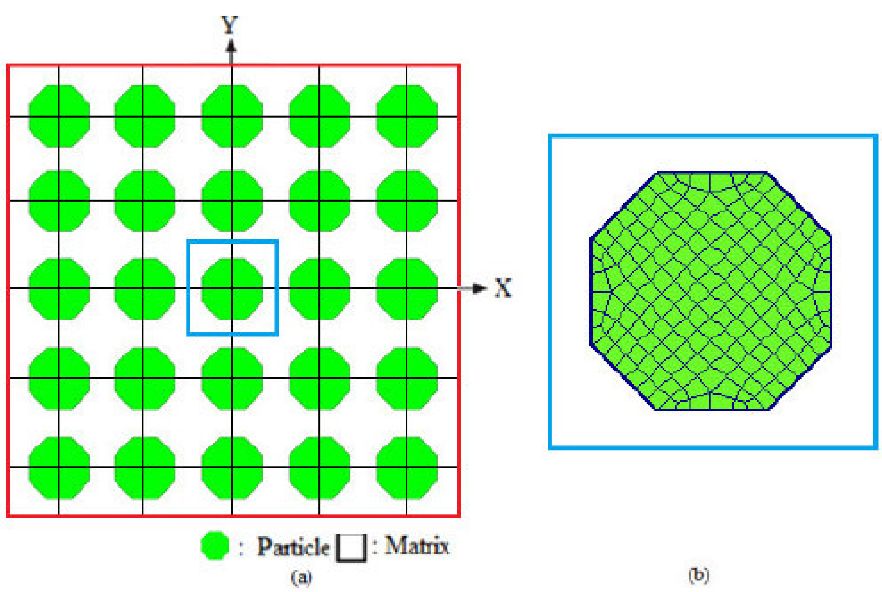

Figure 1: The RVE model: (a) particle distribution and (b) RVE scheme.

The goal of this paper is to estimate debonding and stress bridging based on the elastic moduli, major Poisson's ratio and interfacial tractions of titanium boride/AA4015 alloy metal matrix composites. Finite element analysis (FEA) of TiB2/AA4015 alloy metal matrix composites was executed RVE models comprising of square array cell/octagonal particle.

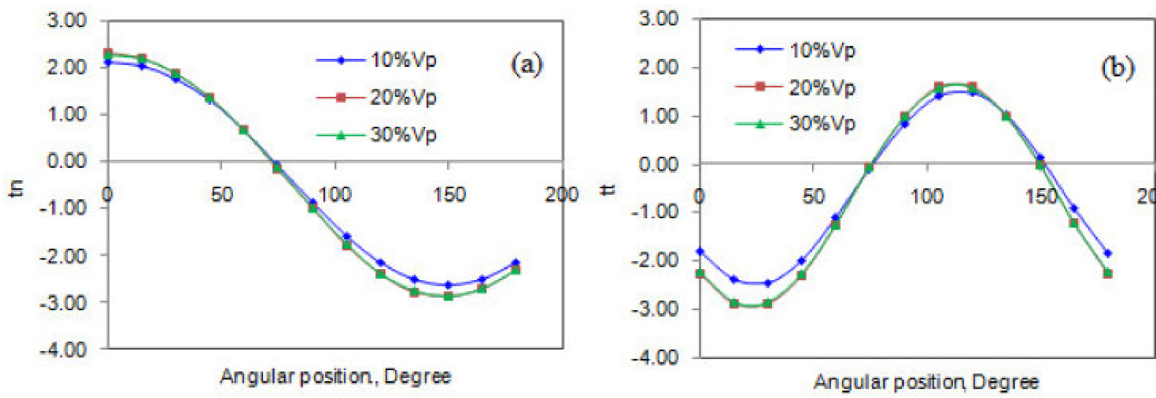

Figure 2: Interfacial tractions along the angle due to tensile loading: (a) normal and (b) tangential.

The shear stress is of same magnitude in the titanium boride and AA4015 alloy matrix for three volume fractions. For the octagonal particulate in AA4015 alloy matrix, the angle of traction between maximum amplitude to minimum amplitude is 150o for the normal interfacial traction and it is 90o for the interfacial tangential traction between minimum amplitude to maximum amplitude. The possibility of debonding is along the direction of tensile loading.

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