Computational Design of Bioinspired Composite Materials: An Approach Based on Numerical Experiments

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ABSTRACT

Possibilities of the optimization of microstructures of metal matrix composites using the biomimicking and numerical micromechanical testing of materials are analyzed. Some recommendations to the improvement of composite microstructures have been formulated on the basis of the analysis of literature about microstructures of biomaterials, and verified in the framework of computational experiments. New numerical tools for the computational testing of heterogeneous microstructures of materials, taking into account their microstructures have been developed, including a new software for the design of 3D finite element meshes of complex materials microstructures and subroutines for the damage simulation. Systematic numerical testing of microstructures of gradient composites, reinforced by staggered platelets, has been carried out. It was shown that the graded composites with bioinspired microstructures, reinforced by staggered platelets, show much better strength and damage resistance, than the composites with usual microstructures.

Keywords: Biomimicking, composites, strength and materials design

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