Nano Finite Element Modeling of the Mechanical Behavior of Biocomposites Using Multi-Scale (Virtual Internal Bond) Finite Element Models

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Abstract

It is evident that biocomposites, specifically Type-I collagen fibrils, have strong mechanical properties, such as a desirable combination of elastic modulus, fracture toughness and fracture strength, while the constituents themselves are relatively weaker in the three aspects. Hence, the objective of this research is to develop, outline, apply and demonstrate issues involving a new nano explicit finite element based framework, by which the mechanical behavior of mineralized collagen fibrils and their constituents can be studied. A multi-scale virtual internal bond model is used to model the material behavior and failure of such biocomposites. In this research two models have been studied. The first model attempts to illustrate the hypothesis that materials are less sensitive to flaws at nanoscale and the second model studies the mechanical behavior of a nano sized dahlite mineral crystal commonly found in collagen fibril.

Keywords: Cohesive model, finite elements.