

Observation and research on the nanoscale structure of chafer cuticle

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ABSTRACT

Insect cuticle, as a natural composite, behaves excellent strength, stiffness and fracture toughness. These favorable mechanical properties can be attributed to its exquisite and intricate microstructures that were optimized by nature through many centuries. SEM observation on the cuticle of Chafer shows that the cuticle is made up of chitin fibers embedded in a protein matrix forming unidirectional sheets and arranged in particular patterns of laminae. The observation also shows that there are many peculiar microfibers including dendritic and spinous ones seldom found in man-made composites. In this paper, the maximal pullout force of dendritic fiber, which is related to the fracture toughness of the composite, is analyzed. The results show that the maximal pullout force of the dendritic fiber is distinctly larger than that of general straight fiber.

Keywords: Natural composite, structural characteristic, dendritic fiber and maximal pullout force