Analyzing Crack Propagation in Spicule-Inspired 3D Printed Structures Through Computer Tomography (CT) Scanning

The replication of biological structures has become a promising approach for improving the mechanical properties of engineered materials. Among these natural structures, spicules—complex cylindrical microstructures—are of particular interest due to their remarkable mechanical strength, largely attributed to their layered architecture. In this study, CT scanning is employed to examine how this innovative structure influences crack propagation between layers and its potential to enhance the framework's toughness. By thoroughly analyzing CT scan data and applying fracture mechanics principles, the study aims to uncover the mechanisms that govern crack behavior within these intricate geometries. Additionally, defects introduced during the SLA printing process are closely examined to assess their impact on the structure's overall integrity. The results of this research are expected to make a significant contribution to the advancement of bio-inspired material design, offering valuable insights for developing tougher, more resilient materials for a range of applications.