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Numerical Investigation of Shock Wave Propagation in Bone-Like Tissue MATT NELMS, ARUNACHALAM RAJENDRAN, University of Mississippi — In this investigation, the effects of shock wave propagation in bone-like biomineralized tissue was investigated. The Alligator gar (Atractosteus spatula) exoskeleton is comprised of many disparate scales that provide a biological analog for potential design of flexible protective material systems. The penetration resistant fish scale was modeled by simulating a plate impact test configuration using ABAQUS®finite element (FE) software. The gar scale is identified as a two-phase, (1) hydroxyapatite mineral and (2) collagen protein, biological composite with two distinct layers where a stiff, ceramic-like ganoine overlays a soft, highly ductile bone. The geometry and variation of elastic modulus were determined from high-resolution scanning electron microscopy and dynamic nanoindentation experimentation to develop an idealized computational model for RVE-based FE simulations. The numerical analysis shows the effects of different functional material property variations on the stress histories and energy dissipation generated by wave propagation. Given the constitutive behaviors of the two layers are distinctly different, a brittle tensile damage model was employed to describe the ganoine and Drucker-Prager plasticity was used for the nonlinear response of the bone.

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