# A computational analysis of ballistic resistance of bio-inspired multilayered panels with functionally graded foam cores

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Based on the structure-property-function relationships of fish scales, the objective of this research is to design multilayered panels to provide maximum ballistic protection for a minimum weight. A multilayered panel consists of a hard external layer, an intermediate energy-aborbed layer, a backing support layer and adhesive layers. The facing external layer is used to blunt and decelerate the projectile, the function of the intermediate layer is to extend the time of projectile and first layer interaction to slow down the projectile more as well as to provide stiff backing support for the external layer, and the backing layer provides containment for the other two layers.

Ceramic (Silicon carbide), aluminium foams (Alporas) with graded relative densities, and an aluminium alloy (AA) 7075 are currently being considered for use in the external, intermediate, and backing layers respectively. A finite element (FE) analysis using ABAQUS is conducted for dynamic penetration process of multilayered panels subjected to high velocity ballistic impact. The various constitutive material models in combination with material failure criteria developed by previous researchers are applied to calculate the dynamic properties of multilayered panels.

The effects of the graded relative density of aluminium foams as well as the number and thickness of layers are investigated. The prediction of the numerical simulations could provide the accurate theoretical support to optimize the ballistic performance of multilayered panels.