Shear Radial Strength: Combining Web Geometry with Shear Thickening Fluids to Create a Better Body Armor

Lynn, Lucas

The purpose of this project is to create a better body armor by testing different woven patterns. Body armor plays a huge factor in the vitality rate of the military. As weapons are becoming more advanced, body armor has to proportionally advance too. The largest issue with advanced body armor is providing protection while not compromising reactivity. This project focuses on a simpler concept in body armor, the way the fabric is woven. This phase included ballistic testing using a BB gun. The samples were constructed from Kevlar in two patterns: grid(used in Kevlar) versus hexagon. One set of samples used Kevlar thread and the other used 1/8” Kevlar chord. They had two layers of foam behind the Kevlar for support. The Kevlar was coated in Shear Thickening Fluid(STF) that was created from Calcium Carbonate and Polyethylene Glycol 200. This was used to make the weave one layer. The thread samples were tested with one shot through the center. A cardboard box was used behind the samples to represent a body. The hexagon thread samples stopped every BB from reaching the box and stopped 2 BBs in the 2nd layer of foam. The grid thread samples stopped none of the BBs. The chord samples were tested with 6 shots in a row. The hexagon stopped all 6 BBs and the grid failed to stop any. Overall, the hexagon performed better which shows it can be used to create a stronger fabric.

Awards Won:

Society for Experimental Mechanics, Inc.: Second Award of $1,500