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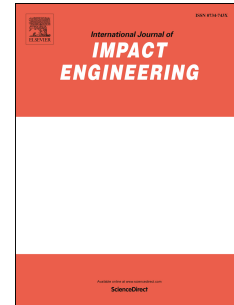
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# 1 Shear thickening fluid impregnated ballistic fabric composites for 2 shock wave mitigation

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## 7 **Abstract**

8 This study reports on the shock wave protective performance of woven Twaron fabric  
9 impregnated with shear thickening fluid (STF). The STF was prepared from a combination of  
10 mechanical and ultrasonic mixing of fumed silica nanoparticles dispersed in liquid  
11 polyethylene glycol (PEG) polymer. The shear thickening characteristics were determined  
12 from rheological tests. Two shock wave parameters governing blast related injuries are used  
13 to evaluate the performance of the STF treated fabrics - peak pressure and rate of pressure  
14 rise. The results of our shock tube tests demonstrate that the STF treated fabric composites  
15 offer superior shock wave protection as compared to untreated (neat) fabric and fabric  
16 impregnated with PEG only. After STF treatment, the normalised average peak pressure  
17 amplification is significantly reduced from 2.46 to 1.49 while the attenuation in normalised  
18 maximum rate of pressure rise is even more pronounced - from 2.3 to 0.76. Apparent material  
19 density is found to correlate with the average peak pressure and maximum rate of pressure  
20 rise. This implies that the density increases enough to increase the equilibrium sound speed in  
21 the fabric, and therefore preclude the formation of shock wave in the fabric. Ballistic tests  
22 using steel projectiles were also conducted to check that the STF treated fabrics continued to  
23 enhance ballistic protection as reported by other researchers. Overall, the results show that

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