

# BALLISTIC IMPACT ENERGY ABSORPTION OF LIGHT PROTECTION BLANKETS

Gerardus Janszen, Davide Lietti, Maurizio Lualdi, Giorgio Novati, Luca Di Landro,  
Politecnico di Milano, Italy

## ABSTRACT

In present times, security procedures against firearms attack have unfortunately gained large relevance even in non-war environment. The use of protections against terrorist events are now being considered also in the design and construction of public spaces and buildings as well as civil vehicles and aircrafts. The chance of employing efficient, yet non-invasive and low-cost solutions, at least against light weapons and or small explosives, can significantly extend the safety levels in different environments commonly accessible. Bullet-proof rolling curtains, light and fixed or movable walls, anti-intrusion/anti-projectile doors, explosion-resistant containment bags are only few examples of relevant applications which have raised interest either by research and industry. In this research, the ballistic protection efficiency of light and flexible systems, which may be integrated in different components, with capacity of shielding from small weapons or blasts, was investigated. In view of approaching optimized arrangements, different configurations of multilayer fabrics were tried in ballistic tests with projectiles ranging from steel balls to firearm bullets. Test blankets with different number of plies, orientation, areal weight were selected; sandwich configurations and the insertion of inter-ply materials were also analyzed. Particular attention was dedicated to the relevance of different energy absorption mechanisms over the projectile impact protection response in view of their efficiency improvement. Numerical methods for the analysis of bullet impacts and deformation contributes were also approached and discussed.

*Keywords: dry composite materials, Kevlar, weapon, mine, protection, static tests, ballistic tests.*