

PROTECTION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL PROTECTION

Agent Permeation And Decontamination Through Reactive Textile Composites

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Air permeable Chemical/Biological (CB) protective garments are typically made from activated carbon-based textiles. However, these sorptive materials have a drawback in that they do not decontaminate the chemical warfare agents (CWAs) trapped within the textile layers and are susceptible to battlefield contaminants. Incorporating novel sorptive and reactive materials into CB protective textiles could potentially allow for CB protective garments to be reused, increase protection against battlefield contaminants, and prevent toxic transfer hazard during doffing. The Multi-functional Materials for CB Protection program, funded by the Joint Science and Technology Office for Chemical and Biological Defense (JSTO-CBD), Defense Threat Reduction Agency (DTRA), has worked towards incorporating novel reactive sorbents into CB protective textiles, optimizing their performance and scaling the processes for incorporation into fibers and textiles.

In this work, novel CB protective textiles comprised of different engineered forms of zirconium hydroxide, the metal organic framework (MOF) UiO-66-NH₂ and combinations of the former with carbon were evaluated for protection against percutaneous threats. The AVLAG (Aerosol Vapor Liquid Assessment Group) permeation apparatus was used to evaluate protection against GD and HD, and the LVAP (Low Volatility Agent Permeation) permeation apparatus was used to evaluate protection against VX. Permeation of the agents and major decontamination products were monitored. At the conclusion of the permeation experiments, a new extraction method was performed on each individual layer of the CB protective composite to quantify residual chemical warfare agents and major decontamination products. The effect of zirconium hydroxide and UiO-66-NH₂ on chemical warfare agent permeation and decontamination of each agent will be discussed.

Approved for Public Release