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Assessing Chemical Protective Capabilities In Coating Technologies

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As painted surfaces age in the presence of chemicals, those targets tend to penetrate into the surface. Standard decontamination processes often fail to remove the chemicals within the paint layer, resulting in secondary exposure hazards when environmental changes lead to reemission of those chemicals. Our ongoing effort is focused on evaluation of coatings suitable for use as a topcoat on painted surfaces to reduce or prevent this target retention following decontamination. A number of recently reported approaches describe the potential for decreasing target penetration into a surface with a resulting improvement in decontamination performance. Unfortunately, many technologies are evaluated exclusively on the basis of the surface wetting characteristics. This ongoing effort has demonstrated a lack of correlation between wetting behaviors and target retention. In addition, handling considerations during simulated exposure and decontamination can have a significant impact on observed chemical retention behavior.

We have evaluated the benefits of several coatings, including those in development and commercially available treatments. The work described here is focused on coatings deposited as top-coat treatments over a polyurethane paint system. The approach taken has been to identify coatings from related areas of research, anti-icing, anti-fog, self-cleaning, anti-smudge, anti-fouling, etc. These coatings are then deposited onto painted aluminum coupons or approaches are adapted to facilitate that deposition. Retention of chemical warfare agent simulants following a simulated decontamination process is evaluated along with droplet diffusion on the surfaces and wetting angles. While several coatings have been synthesized by NRL, the bulk of the tested materials were obtained through collaboration with the innovators of those coatings. Slippery Liquid-Infused Porous Surfaces (SLIPS), Slippery Omniphobic Covalently Attached Liquids (SOCAL), and bioceramic coatings have been considered. The effort has also evaluated coatings based on polyhedral oligomeric silsesquioxanes (POSS) and ferrofluids. We continue to identify and characterize the potential of additional technologies for improving the outcomes of solid surface decontamination. The ongoing effort focuses on identification of technologies developed for other scenarios, such as corrosion protection, that may provide favorable characteristics to this application.

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