NANO-ENGINEERED SELF SEGREGATING ADDITIVES FOR SELF DETOXIFYING COATINGS

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The vast majority of current commercial and military coating and fabric technology provides passive protection towards environmental hazards such as biological pathogens or toxic chemicals, but has no inherent self-decontaminating capability. Materials that undergo autonomous decontamination are highly desirable and could reduce the logistical footprint associated with decontamination operations and could operate as a first line of defense. ARL has identified an approach to produce highly activated self segregating additives that integrate into existing coating and fabric systems. The use of bulk additives to control polymer surface properties in traditional coatings is inefficient, as high levels of additive are typically required to affect surface characteristics which in turn (a) degrade important material properties/performance, (b) create processing problems, and (c) increases cost of the product.

ARL has developed nano-scale materials for coatings that self-assemble at the coating-air interface, as shown in Figure 1. This thermodynamically-driven segregation results in significantly elevated additive concentrations at the polymer surface. The low additive concentration required to modify the coating surface minimizes reduction in physical properties, performance, processing, and cost of the coating system, while having a strong effect on surface properties such as wetting and decontamination of environmental hazards.

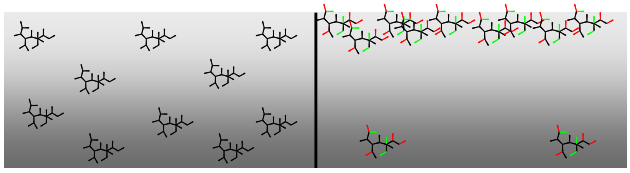
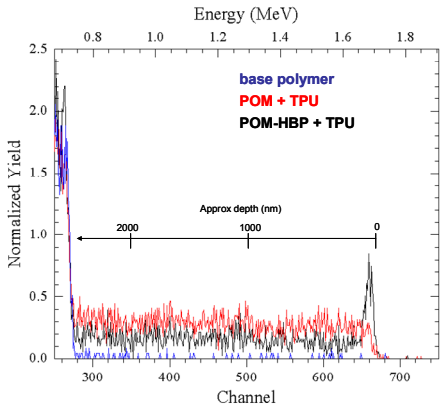


Figure 1: Self Segregation in Coatings

The technology presented here represents a significant advancement over known systems in that it 1) combines the polyfunctional nature of non-entangling additives, such as hyperbranched polymers, to provide a tailored material that 2) is soluble or dispersible within various commercially available paint systems, 3) transports active antimicrobial or decontaminating agents to that interface, and 4) via self assembly, chemically reacts with the coating to prevent leaching of the active agent.



These results indicate that self-segregating additives have the ability to transport a myriad of active materials to the air/polymer surface of a coating; thus, acting as a "Universal Transport Vehicle." These materials may have potential use in coated fabrics, latex paints, etc. for military as well as civilian applications.

1. Joshua A. Orlicki, Wendy E. Kosik, J. Derek Demaree, Matthew S. Bratcher, Robert E. Jensen and Steven H. McKnight, "Surface segregation of branched polyethyleneimines in a thermoplastic polyurethane polymer," Polymer, Volume 48, Issue 10, Pages 2818-2826 (2007)