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30 Engineered Nanoparticle Resuspension Contributing to Inhalation Exposure from Contaminated Protective Clothing

Candace Tsai University of California Los Angeles, Los Angeles, USA

In this study, we investigated engineered nanoparticle (ENP) release associated with the contamination of personal protective clothing during the simulated motion of the human wearing the ENP-contaminated protective clothing and evaluated the relative ENP retention on the fabric. The release of airborne ENPs can contribute to inhalation exposure, which is the route of exposure of most concern to cause adverse health effects in the pulmonary system. The evaluation focuses on four popular fabric materials making the laboratory coats (cotton, polypropylene, polyester cotton blend, and Tyvek®) and three types of ENPs (Al₂O₃, carbon black and CNT). The magnitudes of particle contamination and resuspension were investigated by measuring the number concentration increase of airborne particles in sizes of 10 nm to 10 μm and the weight changes on fabric pieces. Collected aerosol particles and contaminated fabric surfaces were further characterized for understanding particle morphology, elements, agglomeration and surface contamination status. The particle resuspension from contaminated lab coat fabric was found

to vary by the type of fabric material. Cotton fabric showed the highest level of particle resuspension for all three tested ENPs. Data were evaluated to determine the dominant forces responsible for ENP adhesion on the surface of the fabric. Tyvek® fabric was determined as the best fabric for trapping Al₂O₃ and carbon black ENPs indicating less resuspension of particles meaning lower subsequent release, but not durable enough to wear for the long term compared with other fabrics.