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Exposures to Nanoparticles and Fibers during Manufacturing and Recycling of Polycarbonate Carbon Nanotube composites

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Abstract: This study investigated airborne nanoparticle exposures generated during injection molding and grinding of polycarbonate carbon nanotube composites (PC/CNT). Particle number concentration and size distribution were measured using a suite of real time instruments. Area samples were collected using an electrostatic precipitator and examined by transmission electron microscopy for particle morphology. Breathing zone samples were collected on nucleopore filters. Respirable fibers were counted with a scanning electron microscope. The results showed that processing and grinding during recycling of PC/CNT released airborne nanoparticles with a geometric mean (GM) particle concentration from 4.71 x103 to 1.75 x106 particles/cm3. The ratios of GM particle concentration measured during the process to the background particle count were high up to 1.3 (loading), 1.9 (melting), and 1.4 (molding), and 101 (grinding), indicating significant nanoparticle emissions from these processes. The various particle morphologies were observed including respirable and nanoscale particles, particles with protruding CNTs, and fibers, but no free CNTs. The breathing zone respirable fiber concentration during grinding ranged from non-detectable to 0.13 fiber/cm3. No clear evidence that nanoparticle exposures were affected by the number of recycling cycles (up to 20). Exposures controls should be instituted during synthesis, processing and recycling of PC/CNT composites."

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