Workplace measurements of semiconductor nanowires in a small-scale producer

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Semiconductor nanowires (NWs) have the potential to be used in applications e.g. solar cells, light-emitting diodes and batteries. Semiconductor NWs are fibre-shaped manufactured nano-objects, and the industrial use is growing as well as the potential for worker exposure. Aerotaxy is a new method for industrial mass production of NWs. Production takes place in closed reactor systems and NWs of GaAs are grown in the gas-phase on catalytic seed nanoparticles of Au by addition of gaseous precursor molecules. The aerotaxy reactor system is opened up during maintenance e.g. cleaning operations. The aim was to quantify the personal breathing zone (PBZ) exposure and emissions of NWs to air during production and laboratory work at a small-scale producer. The potential for dermal exposure was also assessed. PBZ and emission filter samples were collected for 11 production stages for determination of particle number concentration, mass concentration, and metal content. Also direct-reading instruments were used in the PBZ, emission zone and background to measure particle number concentrations and number size distributions with high time-resolution. Tape samples (N=28) were collected from workplace surfaces in the facilities. Preliminary data based on scanning electron microscopy analysis shows concentrations of up to 0.025 NWs/cm³ in PBZ, and 98.4 NWs/cm³ in the emission zone while maintenance was performed. One surface inside the tool enclosure was contaminated with NWs after maintenance. Thus, the results demonstrate workplace exposure to NWs during maintenance, and the personal protective equipment used for this production stage is essential to avoid worker exposure.