S1.3.3 IN-SITU COLD PLASMA IN WOVEN, NON-WOVEN AND KNIT FABRICS TO INCREASE NANOPARTICLE CAPTURE

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Electrostatics has been widely used with fabrics to enhance particle capture. Charging and particle capture typically occur in two different stages with a high pressure drop. The plasma textile is a new class of filters which offers a compact filtration option. Embedding high voltage wires in the fabric enables simultaneous charging and capture of particles by producing in situ room temperature plasmas. Both woven fabrics and knits can be implemented as plasma textiles by embedding wires in the fabrics, whereas wires can be placed on the surface of the non-woven fabrics. Woven, non-woven and knitted fabrics were developed and experimental investigations conducted on them to determine their filtration efficacy. The spacing and diameter of the wires dictate the intensity of the electric field and hence the efficiency of particle capture. The plasma textiles are active, tunable filters with no charge degradation. Dominant electrostatic forces for ultra-fine particles helps achieve filtration efficiencies close to 100%. A five-log reduction in particle capture was achieved for the non-woven plasma textiles at a mean surface power density of 40 mW/cm^2. Owing to the electrical mobility and hence the weak dependence of filtration efficiency on particle diameter for Coulombic capture, the plasma textiles do not exhibit a most penetrating particle size (MPPS) unlike traditional fabric filters.