Grouping Manipulation of Submicron/Nano Particles for Increased Filtration Efficiency - Smoke and Indoor Applications

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Abstract:

Complete and incomplete combustion of different materials may cause pollution emissions, forming complex mixtures of gaseous and particulate substances, where the particles may have different size distributions. Submicron particles, such as smoke particles, pose significant health risks due to their small size, which allows them to penetrate deep into the lungs. Their potential harm stems from their morphology, chemical composition, and role as carriers of toxic substances or biological agents. Filtration technologies generally exhibit reduced efficiency for particle size smaller than 0.5 μm, creating a critical gap in particle removal. This study aims to investigate numerical and experimental methods of enhancing filtration efficiency by inducing particle grouping, thereby increasing the adequate size of submicron particles to facilitate their capture. The grouping effect is achieved through oscillatory flow, generated by a controlled rotating valve and wavy geometric modules that manipulate the flow dynamics.