Novel Microfluidic Filter Removing Particulate Matter Effectively with Low Pressure Drop

HKUST | Reference: TTC.PA.1152 | April 2019

Background

Particulate matter (PM) is made up of small solid or liquid particles in air that are hazardous and small enough to directly harm our respiratory systems. Filtration-based PM filters are commonly used to remove PM particles, but the high pressure drop and accumulation of particles on the filters are major concerns for users. This invention provides a microfluidic PM removal device with a staggered herringbone micromixer (SHM) that can remove PM particles efficiently while maintaining a low pressure drop to improve user experience. When air enters the device, microvortices are created in the SHM that direct the PM to hit the walls of the device for collection. Compared with conventional PM filters, our device offers the same range of flow rates with smaller cross-sectional areas and a lower pressure drop. The device can be easily regenerated using certain solvents, such as alcohol, to wash away the attached particles.

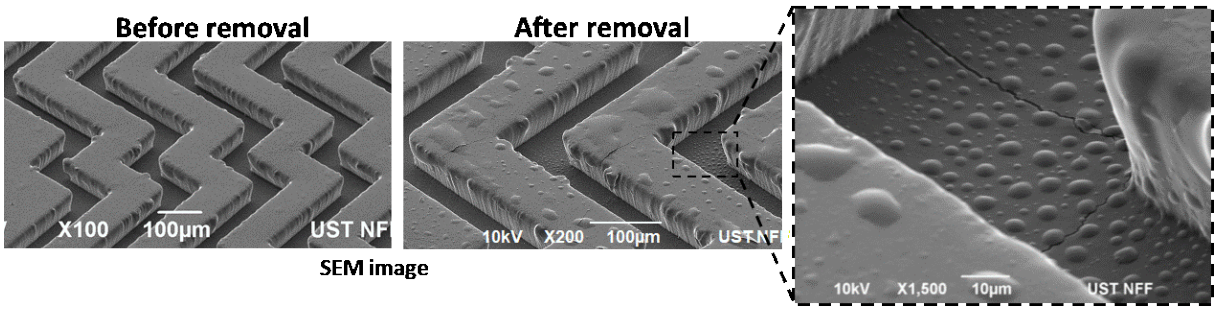
Technology Overview

The fabric filters used in conventional protective masks or air purifiers can filter PM only by having small pores or thick layers; they are not comfortable for users because of the resulting high pressure drop. This pressure drop can increase due to the accumulation of particles on the fabric filters, which may have harmful effects on users. The SMH's unique mechanism of creating microvortices allows the device to have much larger pores while still filtering out small PM, thereby removing PM effectively while maintaining a low pressure drop to improve user experience. It can also be regenerated easily for multiple uses. The new device can be used in air filtration applications such as personal facial masks, air purifiers, ventilation facilities and motor vehicle exhaust filtration, as well as other biomedical applications for therapeutic or research purposes, such as capturing circulating tumour cells, bacteria or large molecules.

Benefits

- High PM removal efficiency with micromixer.
- Low pressure drop due to wide microfluidic channel.
- Large surface area, with herringbone-shaped grooves for PM capture.
- Can be for multiple uses.

Figures



SEM image