

Poly(vinylidene fluoride)(PVDF) Nanofibrous Membranes with Hierarchical Structures for Reusable Air Filters

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We present a hierarchically structured poly(vinylidene fluoride)(PVDF) nanofibrous membrane to achieve high performance air filters with reusability. We demonstrate that additional assembly of silica nanoparticles on an electrospun PVDF nanofibrous membrane and subsequent low-surface-energy treatment enables non-wetting of various probing liquids with surface tension value of over 50.8 mN/m and the membrane to exhibit low roll-off angle ($\sim 15^\circ$) for even 1 μL water and artificial saliva droplets. This allows fine dusts adsorbed on the modified membrane to be easily removed by washing and suppresses adhesion of bacterial suspension. Moreover, the modified membrane is compatible with ethanol sterilization procedure as the membrane exhibit no noticeable alteration in structure and surface wettability upon exposure to either 75% ethanol solution spraying or dipping. We anticipate that applying these hierarchically structured PVDF nanofibrous membrane as a skin layer on top of an unmodified analogue will allow preparation of air filters that simultaneously exhibit high filtration performance, mechanical strength, and reusability.