VCU Innovation Gateway
Office of the Vice President for Research and Innovation

High Efficiency HVAC Filter

Novel Method for Producing Single Sheet High Efficiency MOF Electret Filters

Heating, ventilation, and air conditioning (HVAC) systems are among the most common methods to improve indoor air quality. This is achieved through the use of air filters, which trap and retain pollutants using filter fibers and absorbent particles. However, to do this effectively, current air filters must be thick, with multiple layers of fibers and particles. This excess thickness impedes airflow putting excess strain on the HVAC system and reduces the filters efficiency, resulting in fewer pollutants being removed. VCU researchers have developed a new method that produces an air filter coupled with uniform distribution of metal-organic frameworks (MOFs), which can be seen below, that can effectively remove pollutants while minimizing air impedance and strain on the HVAC system.

Benefits

- Single Sheet Filters
- No adhesives required
- Minimizes air impedance and strain on HVAC system
- Tailorable VOC removal
- 90% less MOFs needed for production

Applications

- HVAC Filters
- Water Filters

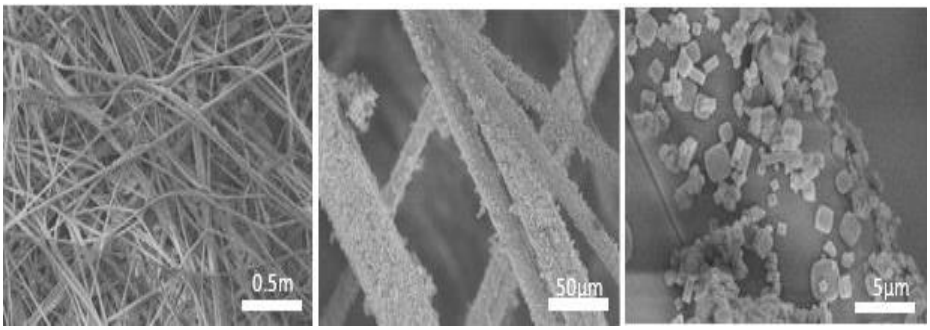

Figure 1. *Scanning electron microscope (SEM) images of the MOFs coating filter fibers. Of note is the even distribution of the MOFs on the filter fibers that is achieved with the novel production method discussed below.*

The technology

The developed method allows for the creation of air filters (E-MOFilter) that minimize air flow impedance while effectively removing particulates, volatile organic compounds, and gaseous pollutants. The filter is comprised of electret media coupled with metal-organic frameworks (MOFs), without the use of adhesive materials.

Adhesion of the MOFs to the filter is instead achieved through the creation of Van der Waals bonds. This method of adhesion creates a uniform distribution of MOFs onto the filter fibers that maintains high filtration efficiency while minimizing the pressure drop across the filter which can be seen in part A of the figure below. By using MOFs, volatile organic compounds such as toluene and formaldehyde can be removed with high efficiency compared to activated charcoal filters which can be seen in part B of the figure below. Moreover, this method of filter production uses 90% less MOFs during production of the E-MOFilter while maintaining filter efficiency.

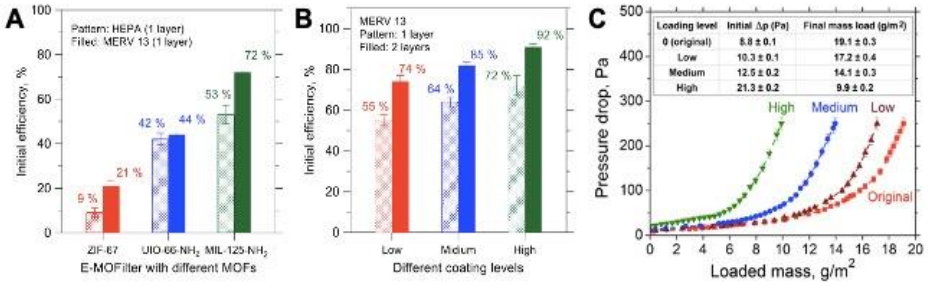

Figure 2. *Shown above is an evaluation of filter function. (A) The difference between HEPA and MERV-13 filter efficiency for toluene removal. (B) The difference between HEPA and MERV-13 filter efficiency for toluene removal after MOF particle coating. (C) Pressure drop between the E-MOFilter with different MOF coating densities and the original fiber filter.*

Additional information

Patent status:
Patent pending: U.S. and foreign rights are available.

License status:
This technology is available for licensing to industry for further development and commercialization.

Category:
Engineering, Materials

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