

Microfibrous entrapped catalysts and sorbents (MFECs and MFESs respectively) consist of particles immobilized in media made of micron-sized fibers (Figure 1, Table 1). The microfibrous media (MFM) may be composed of metal fibers for enhanced heat transfer, ceramic/glass fibers for corrosive environments, or polymer fibers for low-temperature, low-cost applications. Fibers for microfibrous entrapment typically range from 2 to 25 microns and entrapped particles typically range from 40 to 300 microns. These particles are significantly smaller than the extrudates (1.6-5 mm) widely used in industry. The micron-sized fibers dominate the flow pattern, especially at low Reynolds numbers, significantly enhancing mass and heat transfer characteristics.

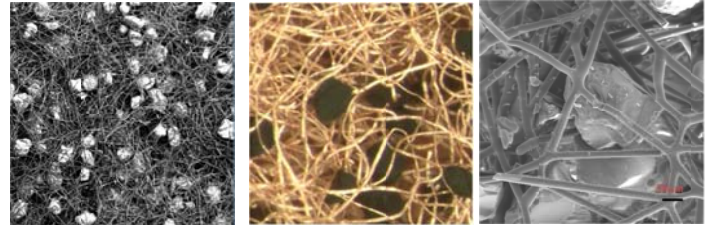


Figure 1. Images of MFECs and MFESs

(Figure 2); however, MFEC and MFES systems are actually fixed beds, so the process disadvantages of fluidized beds are avoided. With fast mass/heat transfer, the reaction rate can be improved by 1-3 orders of magnitude, depending on the specific reactions/process. MFECs and MFESs are very suitable for process intensification, unit/process miniaturization, and portable applications. This technology is already widely used for air filtration, carbon monoxide catalytic filtration, deep desulfurization, Fischer-Tropsch synthesis, and methanol synthesis with many other heterogeneous reactions and processes currently under investigation.

Microfibrous entrapment is achieved using specialized wet-lay-roll-to-roll manufacturing techniques developed by IntraMicron and Auburn University. Most recently, microfibrous entrapment techniques have been advanced to the point that microfibrous media can entrap most pre-manufactured catalysts or sorbents of the right size specifications without contamination.

Table 1. MFEC and MFES Properties

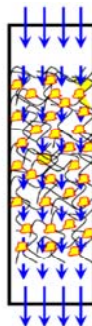
	Volume %		Weight %	
	MFEC	PB	MFEC	PB
Fibers	2-8	-	37-100	-
Particles	0-35	60-70	0-63	100
Void	62-98	30-40	0	0

Flow through an MFEC or MFES is analogous to a frozen fluidized bed. MFECs and MFESs share the advantages of fluidized beds in terms of improved mass and heat transfer because small particles are used

### Microfibrous Matrix

- (1) Uniform velocity profile
- (2) No channeling
- (3) High thermal conductivity (M)
- (4) Better wall contacting
- (5) Fast heat transfer (M)
- (6) Near isothermal temperature profile (M)

(M) Metal MFM only



### Small Catalyst/Adsorbent Particulates

- (1) High external surface area
- (2) Reduced intraparticle diffusion resistance
- (3) Fast mass transfer
- (4) Improved selectivity to large molecules

### Microfibrous Entrapment

- (1) Frozen Fluidized Bed
- (2) Uniform particle distribution
- (3) Random reactor orientation
- (4) No further particle-product separation

Figure 2. Advantages of using microfibrous media (MFM) for catalyst/sorbent entrapment