INTRAMICRON

Microfibrous Entrapment

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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.

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

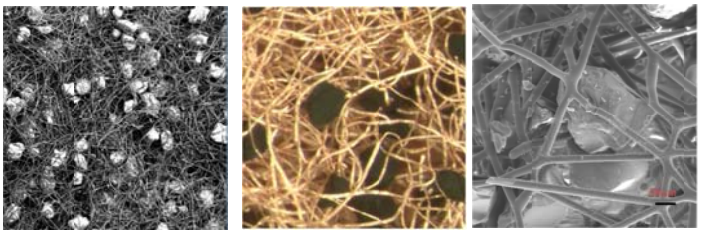


Figure 1. Images of MFECs and MFESs

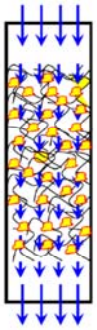
(Figure 2); however, MFEC and MFES systems are actually fixed beds, so the process disadvantages of fluidized beds are avoided. With fast mass/heat transfer, the reaction rate can be improved by 1-3 orders of magnitude, depending on the specific reactions/process. MFECs and MFESs are very suitable for 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.

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