Optimization of Submicron Fiber Production for Filtration

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The benefits of submicron fibers in filtration media are well known. For that reason, several processes exist for creating these fibers such as melt blowing or electrospinning. These processes also can be run at a variety of conditions to produce the media. The fiber sizes, fiber distribution, and aerial density of these media can vary greatly. In order to compare the different processes and optimize the production parameters, a model was developed which incorporates all these variables and allows a proper comparison of media produced.

The optimal media construction depends on the target filter efficiency. The production rate and amount of polymer required have an impact on the cost. Larger diameter fibers tend to give lower efficiency than the same weight of smaller diameter fibers, but the larger fiber can be produced at higher rates. Submicron fibers can achieve high filtration efficiency at relatively low aerial density. This, in turn, makes higher priced polymers cost competitive with commodity polymers. In particular, the playoff between production rate and aerial density requirement can drive the production parameters for a given application.

Experimental results can be analyzed properly to compare samples on a normalized basis so that optimal production parameters can be determined to achieve a specific efficiency requirement. We look at various modeling and experimental analyses which can be valuable in optimizing submicron fiber production.

Bio Sketch

James Sturnfield is a Research Scientist at Dow Chemical. He received a Ph.D. in Mathematics from Purdue University in 1987. His specialty is Process Optimization, Mathematical Modeling and Experimental Design & Analysis. He has been working on the application of various polymers in Electrospinning and Melt Blown Processes.