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A New Explainable Power Demand Model for 4G LTE and 5G NR Base Stations

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19 November 2026

FILTECH

February 24 – 26, 2015
Cologne – Germany

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Abstract Book

February 24 – 26, 2015
Koelnmesse
Cologne · Germany

International Conference & Exhibition for Filtration and Separation Technology

FILTECH 2015

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Abstract Book

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February 24 – 26, 2015

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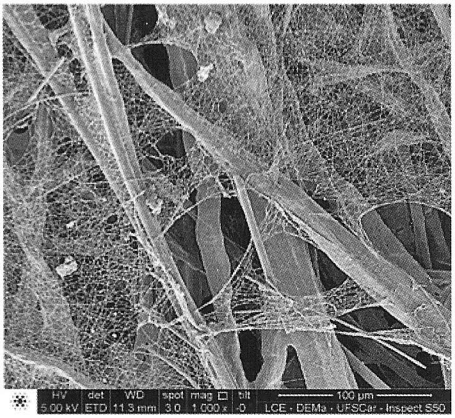
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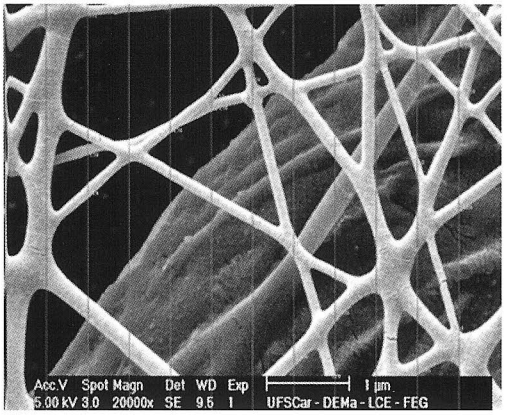
CFD SIMULATION OF NANOFIBER-ENHANCED AIR FILTER MEDIA

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ABSTRACT

The first step in a CFD analysis of filter media flow is to create a computational domain geometry which imitates the simulated media as closely as is practical. The media in the present study combined a relatively flat web of nanofibers with a cellulosic fiber support media. Fig. 1, a SEM image of the material at 1000x, shows the highly random nature of the two media elements, and the difference in scale between them. Fig. 2 is a 20000x SEM image of the same media, showing the polymeric nanofiber web, and behind it, a single cellulosic fiber having a diameter perhaps 100 times the diameter of the nanofiber web elements. A CFD grid suited to calculating the flow patterns through the cellulosic media structure would be far too coarse to simulate flow around the nanofiber web elements. This scale difference forces some assumption about the interaction between the media layers. Our models are limited to two dimensions, representing cross-sections cut through the media





in the direction perpendicular to figures 1 and 2. Our initial studies modeled the nanofiber web alone, on the assumption that the flow around the nanofibers is not greatly influenced by the presence of the downstream cellulosic fibers. It is apparent from Fig. 2 that not all parts of the nanofiber web have circular cross-sections. Our image-analysis technique samples the distribution of fiber diameters by scribing parallel lines across the image (faintly visible here). The diameter of the web element at each line/fiber crossing is tabulated. An estimate is made of the maximum width on the image for which the web element cross-section can be considered circular. We make the assumption that the relatively flat web elements linking round sections have oval cross-sections, all of the same thickness. We found that the distribution of web element widths is "doubly-truncated log-normal", meaning that both lower and upper limits to the widths exist. This geometry was used with a CFD code to calculate particle capture, and compared to results of tests on the actual media.

KEYWORDS

CFD, Nanofiber, Cellulose Fibers, Fiber Size Distribution, Flow simulation