Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Sorting Category: 18. (T)

Modeling of particle capture by mechanical means in automotive air filters BRAD BAILEY, United Space Alliance, FRANK CHAMBERS, MAE, Oklahoma State University — A model was developed to predict the removal of aerosol particles by automotive air filters. Filtration by direct interception, inertial impaction, and diffusion are correlated to dimensionless parameters. A Kuwabara flow field solution corrected for slip is applied to the flow around a single fiber. The contributions of the three filtration mechanisms are combined into a single-fiber efficiency, yielding overall filter performance. The accuracy of the new model is compared to simulated and experimental data of previous authors for two filter media. One medium has a mean fiber diameter of 0.65 μm and is examined for particle diameters of 0.01 to 1.0 μm with filter face velocities from 2 to 8 cm/s. A 2.7 μm diameter medium is considered for particle diameters of 0.1 to 1.0 μm with face velocities of 10 to 140 cm/s. For both media, the new model is a better predictor of filtration than our previous model. However, the results of the new model agreed more closely with experimental data for the larger-diameter medium for Stokes numbers less than 0.3, suggesting that direct interception and inertial impaction are predicted more accurately.

[X] Prefer Oral Session
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Date submitted: 02 Aug 2008 Electronic form version 1.4