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# Nanofiber filter and application of air filter to aerosol measurement

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Air filters consisting of nanofibers are of great interest since they may have a low pressure drop because of slip flow effect and high collection efficiency due to enhanced interception. Kirsch et al.[1)] proposed an empirical equation for the dimensionless drag of air filters based on the measurement of pressure drop of air filters at reduced pressures. However, their empirical equation was derived based on the experiments with filters consisting of micron fibers so that the empirical equation is not verified for nanofiber filters. In the present work, we prepared the nanofiber filters with various physical properties, and the pressure drop was measured at reduced pressures in order to examine the validity of the empirical equation. As a result, we found that the empirical equation proposed by Kirsch et al. is valid even for nanofiber filter and that the inhomogeneity factor is the dominant parameter on the slip flow.

We may use air filters not only for the removal of particles but also for classification of particles by selecting an appropriate filter by operating it under an optimized filtration condition for classification. In the present work, the centrifugal filter proposed by the authors (Nakajima et al., 2015) was applied to classify aerosol particles followed by the detection of total mass aerosol concentrations as to measure the size distribution of aerosol particles (Tanaka et al., 2017). The structure and operating condition of centrifugal filter were optimized in order to attain sharp separation curves with various cut-off sizes between 0.3 and 10 μm. The aerosol concentration penetrating the centrifugal filter at various rotation speeds was measured with a photometer to determine the total mass concentration. The virtue of this system is such that the cut-off size is varied just by scanning the rotation speed of filter and that it can be applied to the measurement of high concentration aerosols without dilution by choosing an appropriate filter medium.

References

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