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Online Monitoring of Concentrations of Aerosol Nanoparticles and Associated Black Carbon Using CPC and Black Carbon Monitor with $PM_{0.1}$ Inertial Filter

Thunyapat Thongyen, Mitsuhiko Hata, Yoshio Otani, Masami Furuuchi
Kanazawa University, College of Science and Engineering,
Kakuma-machi, Kanazawa, Japany
thunyapa@stu.kanazawa-u.ac.jp; hata@se.kanazawa-u.ac.jp; otani@se.kanazawa-u.ac.jp;
mfuruch@staff.kanazawa-u.ac.jp

Takuji Ikeda
Nitta Cooperation, 172 Ikezawacho, Yamatokōriyama, Nara 639-1085, Japan
Ta_Ikeda@nitta.co.jp

Hiromi Koyama
Shibata Scientific Technology, Tokyo 113-0034, Japan
koyama@sibata.co.jp

Extended Abstract

A $PM_{0.1}$ separator, which has been originally devised for a personal sampler for the evaluation of exposure to nanoparticles (Thongyen et al., 2013), was applied as a simple tool to the online and simultaneous monitoring of the number concentration of environmental aerosol nanoparticles and the mass concentration of nanoparticle-bound black carbon with the combination of a condensation particle counter (CPC) and a black carbon monitor (BCM). The $PM_{0.1}$ separator, which is based on the inertial filter technology (Otani et al., 2007), consists of two tandem inertial filters with cut-off sizes of 450 and 100 nm located downstream pre-cut impactors ($PM_{5.6/1.4}$), was designed to provide 100 nm cut-off size at 5 L/min of air sampling flow rate under a moderate total pressure drop of ~ 6 kPa, which is low enough to be operated along with the above instruments. The main inertial filter consists of layered square mesh TEM grids sandwiched by spacers in a circular nozzle through an aluminium cartridge. Another inertial filter located upstream the main inertial filter consisting of webbed SUS fibers packed in a circular nozzle was used as a pre-cut filter to remove coarse particles clogging and bouncing on the main inertial filter.

After confirming the separation performance of $PM_{0.1}$ separator following a reported procedure (Furuuchi et al., 2010), the $PM_{0.1}$ separator was applied to the monitoring of $PM_{0.1}$ number concentration and associated black carbon mass concentration. The outflow from the $PM_{0.1}$ separator was connected both to a CPC (TSI, Model 3785) and a BCM (TSI, Model AE51) for the validation test using ambient aerosol particles as test particles, compared with data from simultaneous measurement by a scanning mobility particle sizer (SMPS) and carbon mass concentration in particles collected on a filter. The present $PM_{0.1}$ monitoring system was shown to be a possible simple tool for the online monitoring of number concentration of $PM_{0.1}$ particles and the mass concentration of nanoparticle-bound black carbon.

References

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