Nanoparticle Filtration for Car Cabins

S. Loretz, H. Burtscher, A. Keller,
University of Applied Sciences, North-Western Switzerland, CH-5210 Windisch, Switzerland
A. Mayer, TTM A. Mayer, CH-5443 Niederrohrdorf, Switzerland
M. Kasper, Matter Engineering AG, CH-5610 Wohlen, Switzerland
J. Czerwinski, University of Engineering and Information Technology, CH-2502 Biel, Switzerland
R.J. Artley, R. Strasser, ETeCH AG, CH-8952 Schlieren, Switzerland

Introduction
Many recent studies have highlighted the severe medical dangers of nanoparticles as produced by vehicle exhausts, which can often reach 250,000/cc on busy roads for extended periods, with peak values of over 1,000,000/cc, compared to a ‘clean’ ambient level, experienced in remote woodland, of 5,000/cc or less. We demonstrate that existing vehicle ventilation systems mainly do not remove these, so that the nanoparticle concentration inside vehicles is similar to, or in some cases considerably higher than the levels experienced on the road outside the vehicle (Fig. 1).

The nanoparticle filtration system
We have developed a range of retrofit filtration systems which reduce airborne nanoparticle concentrations inside vehicles to ‘clean’ ambient levels. These new filtration systems are compact and simple to construct, install and maintain, and it is expected that commercial versions will be available shortly. Systems for use in buildings are now under test.

Technology
The technology uses a small, high performance fan to draw air through a filter operated at low face velocity. External air from outside the vehicle is filtered in a single pass through first a pre-filter and then the novel nanoparticle filter. Prototype units, in round as well as in square form, have been constructed (Fig. 2).

Results
Numerous full-scale prototypes have been road-tested in a variety of makes of cars, school-buses, coaches and trucks under an extensive variety of environmental and traffic conditions, including high-exposure urban, traffic-jam and tunnel situations. These filtration systems can ‘clean down’ the internal cabin air within a few minutes, remove 95-99% of the nanoparticles from the incoming air, and allow a low level of nanoparticles, equivalent to ‘clean’ ambient levels, to be maintained whatever the external conditions (Fig. 3 and 4). They also remove viruses and other airborne pathogens. There have been no problems concerned with noise, clogging, CO2 levels, or humidity. One prototype was successful tested in a tunnel (90 000 vehicles/day) during 1500 hours.

Contact: siegfried.loretz@fhnw.ch