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Focus on IFA's work

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Respiratory protection against ultrafine particles

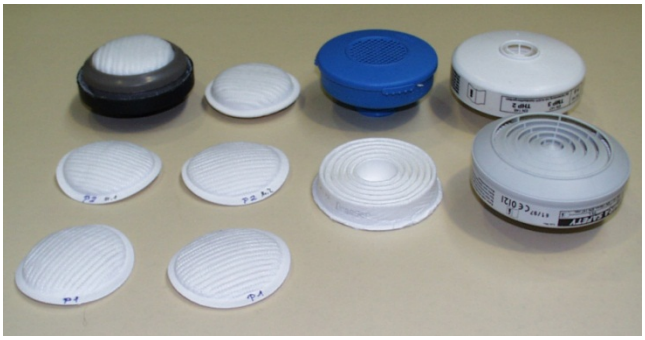
Problem

Ultrafine aerosol particles (below 100 nm) arise in particular as condensation products during thermal and chemical processes. Examples are welding fumes, metal and polymer fumes, industrial soot, amorphous silica, and particulate diesel engine emissions. The primary particles produced measure in the order of a few nanometres (1 nm = 1 millionth of a millimetre) before clustering to form larger particles or becoming attached to larger dust particles. Scientific evidence exists of certain types of ultrafine particles presenting a health hazard.

Where technical and organizational protective measures are inadequate at workplaces exhibiting large concentrations of ultrafine particles, adequate respiratory protective devices must be worn. Widespread concern exists that such small particles might not be retained by the particle filters available on the market.

Activities

In order to permit assessment of the effectiveness of approved respiratory protective devices against ultrafine particles, the IFA conducted pilot measurements on selected respiratory filters and measured the permeability characteristics of respiratory filters for harmless common salt aerosols with particle sizes of < 100 nm nm (for the greater part around 40 nm).



Filters for breathing masks

The number concentration following passage through the filter was measured and compared to the concentration outside the mask. The scanning mobility particle sizer (SMPS) was employed for this purpose.

Results and Application

Studies performed on glassfibre filters of various filter classes (P1, P2, P3) show that the relevant provisions of European standards governing the permeability are reliably met for all three performance categories. The characteristics already known for particulate air filters are thus also confirmed for respiratory protective devices.

Random movement (diffusion) of the ultrafine particles causes them to be filtered off inside the filtering layer. The principle of sieving granulate bulk material, i.e. the finer the particles, the more easily they pass, evidently fails to apply in the case of ultrafine particles.

Where a suitable filter class is selected (P3, FFP3), well over 99% of the fine and ultrafine particles can be separated off. By contrast, leakage-free fit of the breathing mask presents the real problem for the use of respiratory protective devices. This aspect is all too easily neglected during discussions of particle size.

Area of Application

Metalworking trades and industries, foundries, electrical industry, chemical industry, foodstuffs manufacture, vehicle operation, safety professionals, prevention staff

Additional Information

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- NANOSAFE 2 Dissemination Report on protective devices http://www.nanosafe.org/home/liblocal/docs/Dissemination report/DR1_s.pdf

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Expert Assistance

IFA, Division 3: Hazardous substances: handling – protective measures

Literature Requests

IFA, Zentralbereich

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