

# Focus on IFA's work

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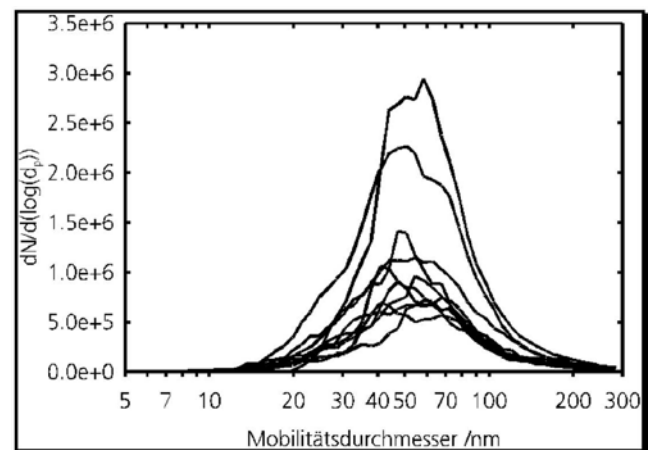
## Ultra-fine particles at the workplace

### Problem

There appears to be a particular health risk from ultra-fine dust particles in respiratory air. Ultra-fine aerosol particles are for the most part the product of condensation in thermal and chemical reactions. Typical examples include welding fumes, metal fumes, polymer fumes, technical soot particles, amorphous silicic acids, and particulate diesel motor emissions. The primary particles that are thus created have a size of only a few nanometres (nm). They also agglomerate directly after formation and form even larger particles.

Aiding the assessment of dust exposure at the workplace, the European standard EN 481 defines the proportion of dusts that can be inhaled and penetrate the alveoli. Such a definition does not exist for the proportion of ultra-fine particles. This can in part be traced to the paucity of information from occupational medicine in this area.

The threshold limit values for dust in occupational hygiene (inhalable and respirable dust fraction) – excluding fibres – are related to the mass of the dust. These fractions do include particles smaller than 100nm; yet while these ultra-fine particles make up more than 80% of the total particles, their proportion of the total mass is negligible. Various experimental results and observation studies strongly suggest that ultra-fine particles have a stronger effect on the human organism than an equal mass of larger particles when insoluble. The effects here do not seem related to the mass of particles, but rather to their number.



Distribution of ultra-fine particles in a foundry.  
 Total particle quantity :  $5.8 \cdot 10^5 / \text{cm}^3$ , Maximum 54nm,  
 Inhalable dust fraction:  $1.65 \text{ mg/m}^3$

### Activities

The IFA, in conjunction with the German institutions for social accident insurance, carried out a measurement programme at selected workplaces. The aim was to gather and catalogue technical measurement information on ultra-fine particles arising from different work processes. The particle size distribution between approximately 10nm and 500nm and the number concentration of these particles were determined. IFA was equipped with a suitable measurement device (scanning mobility particle sizer – SMPS) for these particular measurements. The illustration depicts a set of measurement results from a foundry.

## Results and Application

Using the resulting data sets on ultra-fine aerosols at workplaces, the institutions for social accident insurance hope to contribute to a helpful discussion on this topic, and improve the possible methods of prevention.

## Area of Application

The industries and skilled trades in metal-working, forges and foundries, the electrical industry, the chemical industry, foods production, motor vehicle maintenance, measurement centres, occupational physicians, toxicologists, and the organisations for setting standards and safety limits.

## Additional Information

- [www.dguv.de/ifa](http://www.dguv.de/ifa), Webcode [e95204](#) Technical information on Ultrafine aerosols and nanoparticles at the workplace
- DIN EN 481: Arbeitsplatzatmosphäre; Festlegung der Teilchengrößenverteilung zur Messung luftgetragener Partikel (09.93). Beuth, Berlin 1993
- Ultrafeine (Aerosol-)Teilchen und deren Agglomerate und Aggregate (Kennzahl 0412/5). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 38. Lfg. IV/2007. Hrsg.: Deutsche Gesetzliche Unfallversicherung (DGUV), Sankt Augustin. Erich Schmidt, Berlin 2011 – Losebl.-Ausg.  
[www.ifa-arbeitsmappdigital.de/0412.5](http://www.ifa-arbeitsmappdigital.de/0412.5)

- Möhlmann, C.: Ultrafeine Aerosole am Arbeitsplatz (Kennzahl 120130). In: IFA-Handbuch. Lfg.2, IX/2007. Hrsg.: Deutsche Gesetzliche Unfallversicherung (DGUV), Sankt Augustin. Erich Schmidt, Berlin 2003 – Losebl.-Ausg.  
[www.ifa-handbuchdigital.de/120130](http://www.ifa-handbuchdigital.de/120130)
- BIA-Workshop "Ultrafine aerosols at workplaces". BIA-Report 7/2003e. Published by: Hauptverband der gewerblichen Berufsgenossenschaften (HVBG), Sankt Augustin 2004  
[www.dguv.de/ifa](http://www.dguv.de/ifa), Webcode [e22065](#)
- Pelzer, J.; Bischof, O.; van den Brink, W.; Fierz, M.; Gnewuch, H.; Isherwood, H.; Kasper, M.; Knecht, A.; Krinke, T.; Zerrath, A.: [Geräte zur Messung der Anzahlkonzentration von Nanopartikeln](#) – Aktueller Überblick über die Messtechnik, Gefahrstoffe – Reinhaltung der Luft 70 (2010) Nr. 11/12, S. 469-477

## Expert Assistance

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

## Literature Requests

IFA, Zentralbereich