Be sure. testo

Measure and classify nanoparticles at the touch of a button.

With the portable particle counter testo DiSCmini.

Is your air clean or not?

Mobile nanoparticle measurement and monitoring with testo DiSCmini gives you certainty at the touch of a button.

Nanoparticles are an invisible danger. Unperceived by us, they surround us. They often carry health-damaging substances. From a scientific point of view, it is now undisputed that aerosols from the most diverse sources endanger health because the particles' size enables them to penetrate deep into the lungs. It is therefore all the more important to measure the nanoparticle concentration at especially contaminated sites regularly.

These areas can be especially hazardous:

- **Public areas with heavy road traffic (diesel soot)**
- **Soldering workplaces (formaldehyde)**
- **Welding workplaces (metal oxides)**
- **Foundries (phenoles)**
- **Office workplaces (toner dust from printers and copiers)**

How does testo DiSCmini support you in dealing with hazards from nanoparticles? Briefly: By measuring where people are. The particle counter is handy and can be moved independently of position during the measurement. You thus obtain the real particle values to which people are exposed at their workplaces or elsewhere – allowing you to take the necessary steps.

On the next pages, you will find an expert interview containing all questions on nanoparticle measurement. It also tells you how nanoparticles cause physical harm, and why it is so important to measure in the vicinity of humans. On the last two pages, you can find out how to use testo DiSCmini, and which advantages a portable particle counter has over a CPC.

We hope you enjoy reading!

Why measure nanoparticles?

A conversation with our expert, Prof. em. Dr. Peter Gehr (Institute of Anatomy, University of Bern)

Where do nanoparticles occur?

Everywhere. With every breath, you inhale millions of different particles. Most of them are nanoparticles.

Which types of nanoparticles are there?

We need to differentiate between two groups of nanoparticles. On the one hand, there those which occur in combustion processes. These are exhaust gases which are created by road traffic or heating systems. They constitute the majority. Then there are artificial nanoparticles such as titanium oxide, metals, metal oxides and carbon nanotubes.

And why are nanoparticles harmful to us?

In a biological environment such as a human being, the larger particles behave differently to the nanoparticles. Because they are so small, the nanoparticles we inhale travel to the deepest part of our lungs, the alveoli. Nanoparticles have the property of being able to penetrate cells and tissue easily. This way, they pass into the blood vessels from the alveoli, and from there into the whole organism. Large particles can't do this. In my opinion, it's this that makes them so dangerous compared to larger particles.

What are the medical consequences?

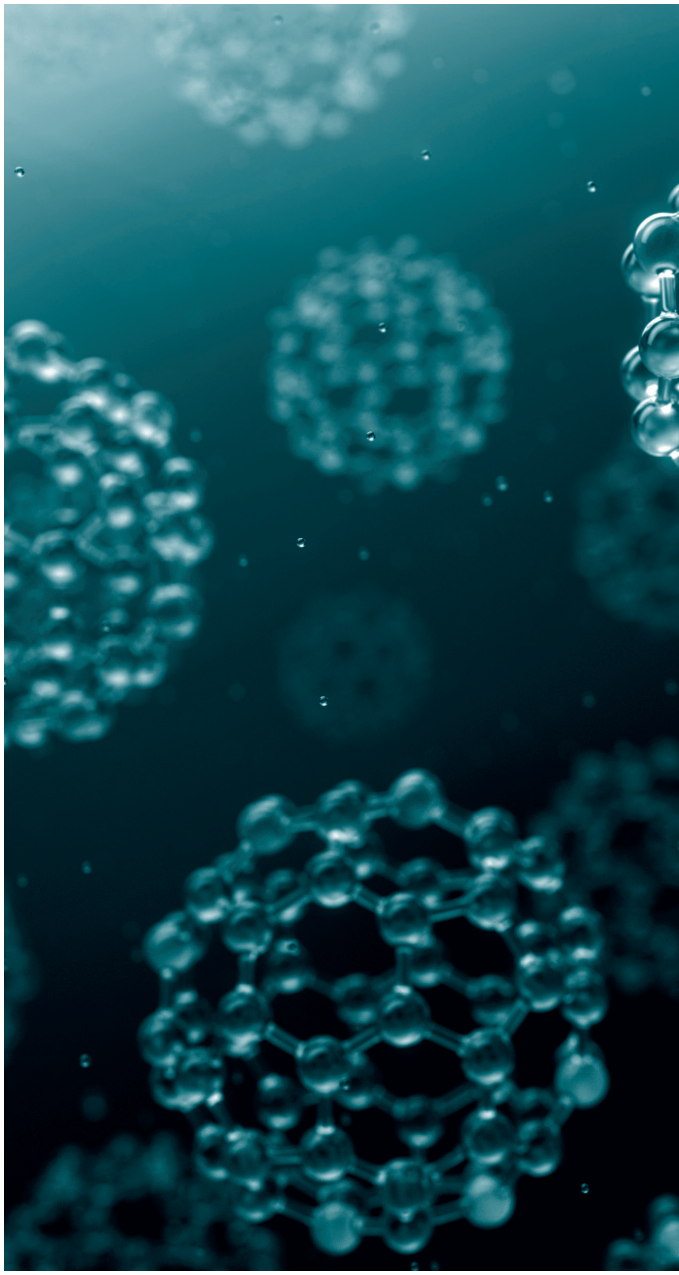
The harmful consequence that we know of to date is the destruction of the cell. The nanoparticle can penetrate into the cell and damage the genetic material. It can also lead to uncontrolled cell division, which can potentially cause cancer. Experts refer to this as "genotoxicity". This means that nanoparticles can lead to genetic damage. However, more research is needed in this field.

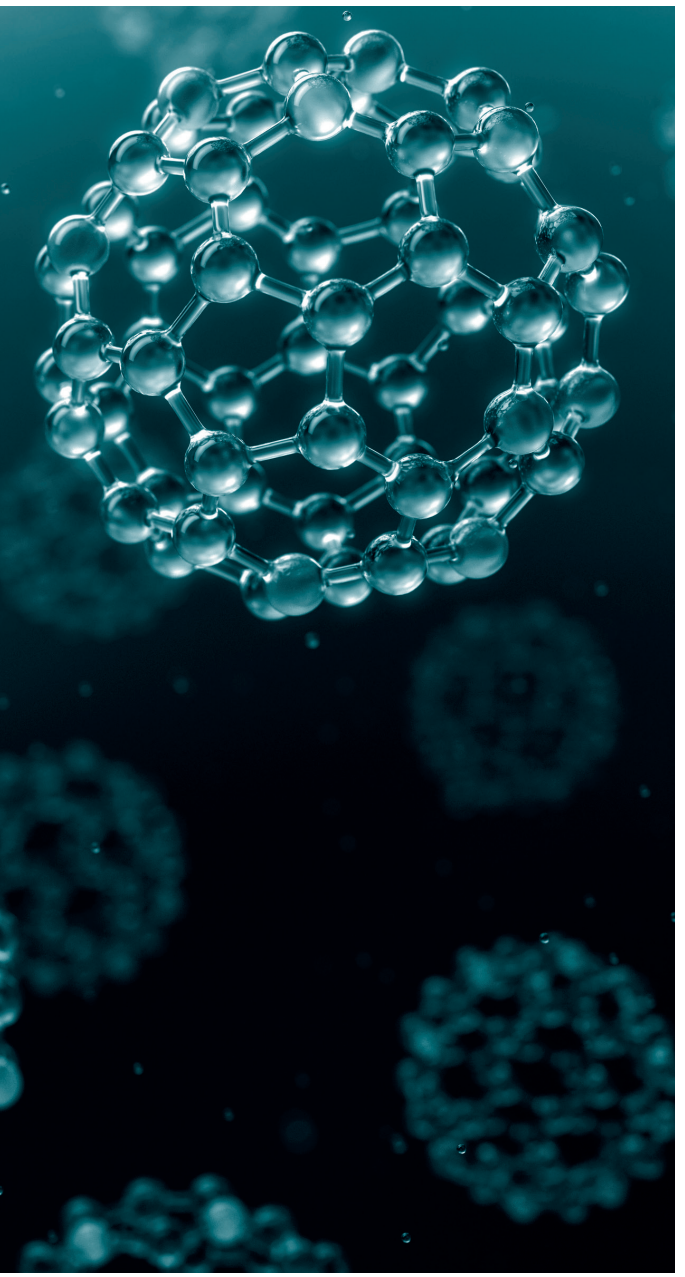
Why is it so important to carry out nanoparticle measurements in the vicinity of humans?

Like the name says, nanoparticles are so small that they hardly sink to the ground. Unless they clump together; then they immediately sink to the ground and are deposited. This means they are no longer measurable in the air. On the other hand, nanoparticles are much more inert than gas molecules. This makes them tend to stay closer to their source. The concentration of nanoparticles which occur in road traffic decreases considerably within just a few metres, since they move so slowly from one place. If the effects on humans are to be tested, one has to determine which nanoparticles are present in the direct vicinity of a person, and in which concentration and size. Many nanoparticles are no longer present if the measurement is taken further away.

There are two measurement methods: nanoparticle counting and mass measurement. Mass measurement is the method most commonly used. Why is a mass measurement with PM10 not meaningful for nanoparticles, and why is it important to count nanoparticles?

The advocates of PM10 measurements are of the opinion that measurements can be conducted very easily, as there





are measurement stations everywhere. However: If you use mass measurement, the nanoparticles are simply not recorded. A PM10 measurement provides no information on nanoparticles at all. However, nanoparticles can be more damaging to the organism than larger particles, since they can penetrate relatively easily into cells, tissue and blood vessels when inhaled. For this reason, measurements should be carried out close to the body. This burden is only recorded when the number of nanoparticles is measured.

So could we say, expressed simply, that PM10 or PM2.5 continue to be important measurement procedures, but that nanoparticle measurement is just as important as a complement?

Yes, nanoparticle counting is an important complement. And in my opinion, it will replace PM10 in the long term. The reason is simple: there are new insights about which particles are particularly harmful. Today we know that many of the large particles which are recorded with PM10 present no danger to health. It is often the very small carbon particles, on the other hand, the so-called industrial soots, which cause problems. These are only measured rudimentarily with PM10. In contrast, a nanoparticle measurement allows a measurement of air quality by counting the industrial soots. For example: Under inversion weather conditions, a speed limit of 50 mph (80 km/h) is applied on city highways. However, this led to only a very slight decrease of PM10 in measurements. I believe that with a measurement of the industrial soot number, i.e. not just the PM10 fraction nanoparticles, but also of the industrial soot fraction, considerably greater differences would have been recorded. The example shows that particle size is the more suitable parameter for recoding critical nanoparticles – and thus also the better basis for decisions.

And why are there emission guidelines for motor vehicles which regulate the emission of nanoparticles, but no standards for ambient air?

I think it's not generally known that nanoparticle number and size can be easily measured. At the touch of a button, a value can be called up which is reliable and can be recorded at intervals of seconds. And you can do it indoors and out, and even get into a car. You can observe how the values increase and decrease. This is why particle counting is a big step in the right direction. We have a very good way of measuring air quality available to us.

Measure and classify nanoparticles. Any time. Anywhere.

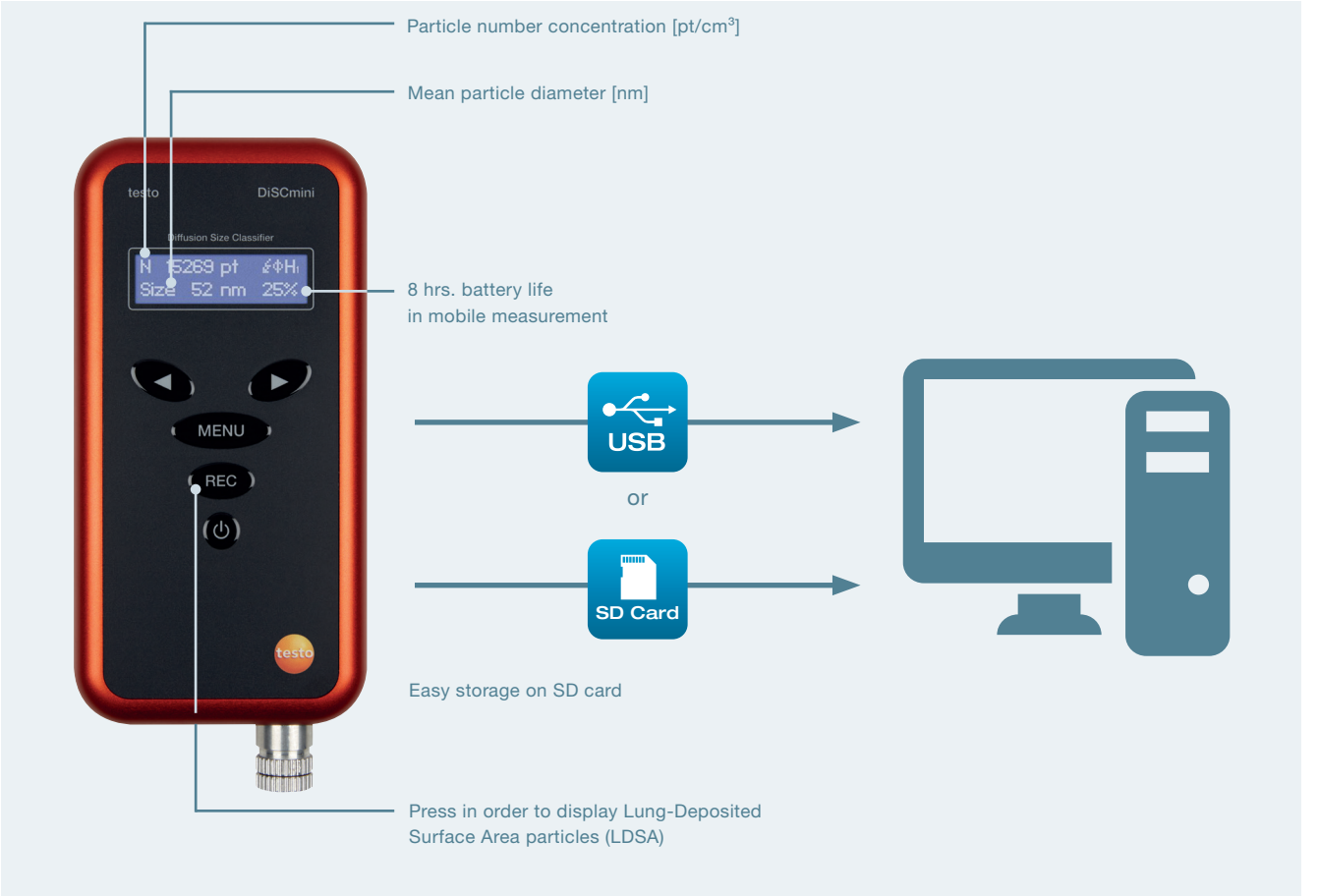
It is that easy with the testo DiSCmini.

The testo DiSCmini is the smallest instrument on the market which can measure nanoparticle number. It has a patented sensor and can be used independently of position.

The portable particle counter can be used for recording personal contamination or for fast non-stationary measurements in important environments such as workplaces or city areas with high traffic levels. Raw data files are stored on an SD card and can be directly imported in Excel or analyzed with a cross-platform software tool.

The application areas of testoDiSCmini at a glance:

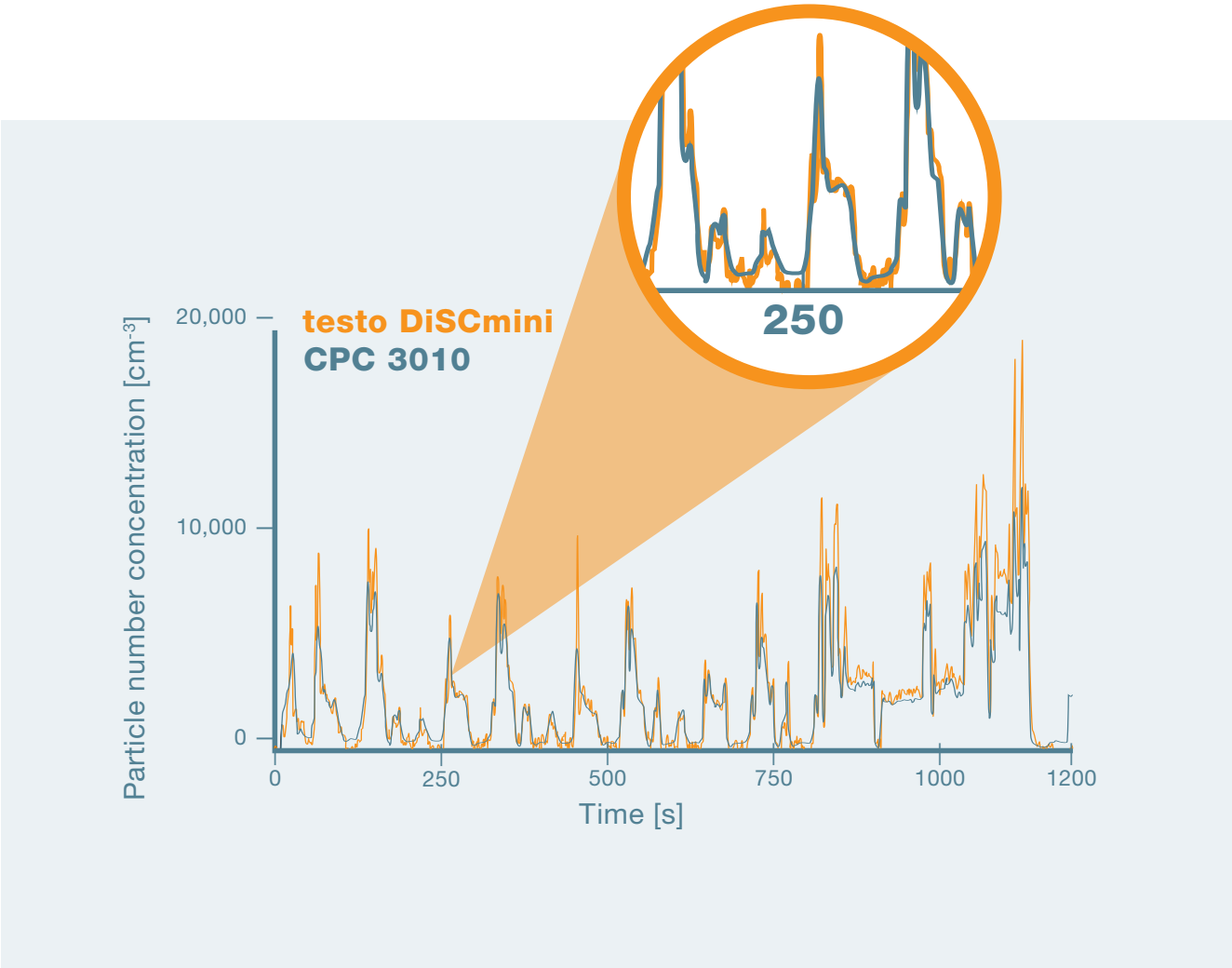
- Exact recording of personal contamination
- Reliable workplace risk evaluation
- Fast testing of filter efficiency
- Easy mapping of air pollution with one mobile, or several stationary instruments



Accuracy which stands up to any comparison.

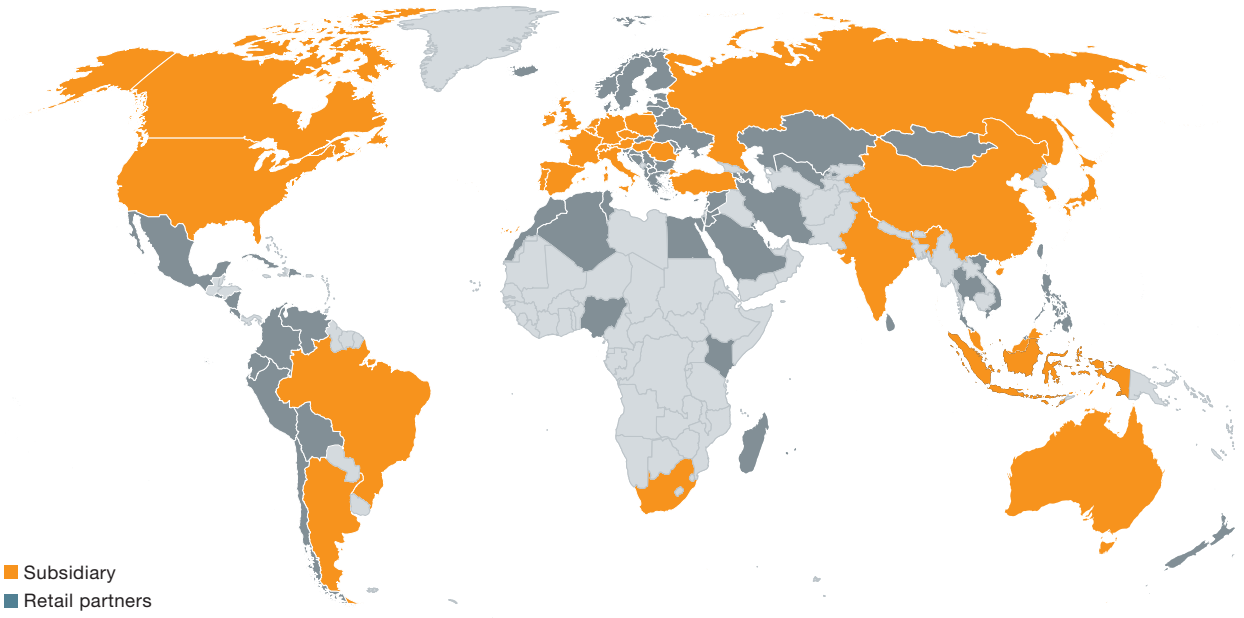
The advantages in comparison to a condensation particle counter (CPC).

- testo DiSCmini is light enough to be carried by hand, and is immediately ready for use without pre-settings and calibrations. The instrument is insensitive to vibrations and can be operated independently of position.
- No flammable operating materials or radioactive radiation sources are required.
- Particle number concentration, modal diameter and Lung-Deposited Surface Area particles are measured simultaneously and at intervals of seconds.
- testo DiSCmini records the hazardous small particles of less than half a micrometre in diameter.
- The measurement accuracy is between 15-20% in comparison to a reference CPC.
- Thanks to its low weight, testo DiSCmini is also suitable for aerial measurements using drones.



Be sure. testo

Your partner
for nanoparticle management



The specialist for nanoparticle management, Matter Aerosol AG, has been part of the Testo family since 2010. With the full integration of the nanoparticle measurement technology business sector in 2015, Testo is pursuing the objective of a targeted and customer-oriented utilization of the synergies in Research & Development, as well as the extensive and proven possibilities and means available in industrial production, service and sales.

Matter Aerosol's comprehensive, specialized and recognized know-how in the Research & Development sector is now complemented by Testo's 60 years of experience as a world market leader in the field of professional measurement technology. Thanks to this new structure, dovetailed solutions in the field of nanoparticle measurement will continue to be developed for you in the future.