Product data sheet

Palas® XRC 049

Applications

- Neutralization for SMPS systems
- Neutralization for filter test systems
- Neutralization for diverse measuring tasks and to avoid particle_ losses due to electrostatic deposition
- Aerosol research
- Laboratory and field measurements

Benefits

- Reliable method for setting defined bipolar charge distributions
- Powerful alternative to radioactive neutralizers
- Flexibility in operation, no additional operating license required in most countries
- Can be integrated into U-SMPS / DEMC control unit
- After switching on full performance available, after switching off no further ionization
- Suitable for concentrations up to 10^7 particles/cm^3

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Description

The XRC 049 is a neutralizer on the basis of X-ray ionization. It can be used the same way as the Kr-85-370 (for example in SMPS systems), i.e. when the measurement task requires a reliable and defined charge distribution of the aerosol. The XRC 049 is especially suitable for mobile measurements performed at different locations, as there are no official requirements for the transport that need to be considered in most countries. The XRC 049 is a bipolar neutralizer generating positive and negative ions through ionization. If these ions are brought together with an aerosol, a defined equilibrium charge distribution is set, as it is necessary for measuring systems such as a scanning mobility particle sizer (e.g. Palas®U-SMPS*). Compared to an unipolar neutralization, a bipolar neutralization has a significant advantage: regardless of the initial state of charge of the particles, a reproducible equilibrium charge distribution is always set. This is why a bipolar neutralization is mandatory for a traceable calibration of a condensation particle counter (e.g. ISO/CD 27891). The XRC 049 can be integrated into the U-SMPS / DEMC control unit (figure 3). The full performance is immediately available after switching on the device, after switching off no ionization takes place and therefore no further radiation.

Quality in Detail

Function

The highly-energized X-rays ionize the carrier gas. As a first result of the ionization process, positively charged gas ions and free electrons are generated. Neutral gas molecules with a strong electron affinity (e.g. O_2) collect the free electrons to build negatively charged ions.
When, at this point, aerosol particles are exposed to this mixture of ions during a determined period of time, the charge level of the aerosol particles is set at a defined equilibrium charge distribution. Figure 1 shows a schematic set-up of the X-ray source. In the light blue area ions (in dark blue) are generated. The aerosol particles (grey) pass through the light blue area and collide with the ions.

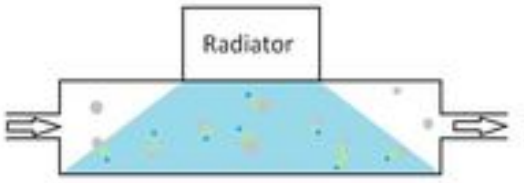

Figure 1: Schematic set-up of XRC 049

Performance

The XRC 049 was characterized and tested during the research of a bachelor thesis. It was analysed if it is suitable as an alternative to a Kr-85 neutralizer.
It was found that the following parameters have either no effect or only little effect on the neutralization of the aerosol particles:

- Switch-on behaviour
- Volume flow
- Particle material
- Concentration

An important advantage of the XRC 049 is that it can be switched off. This extends the life significantly, as only in operation the electrodes are charged, so that the source can often be used over several years. If it is switched off, no ionization takes place and no radioation exposes. Therefore it can be transported without restrictions. The XRC 049 does not need any warm-up period. Directly after switching on the aerosol is completely neutralized (figure 2).

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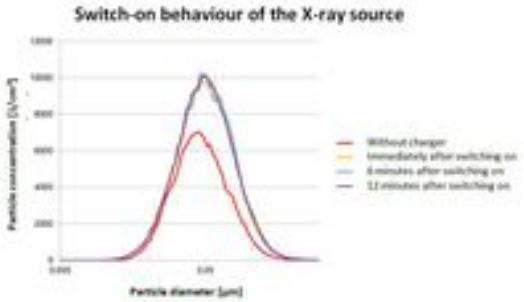

Figure 2: Distribution measurement for the determination of the switch-on behaviour of the XRC X-ray source

Furthermore it has been tested if the neutralization decreases at a defined volume flow. For this, measurements have been performed at different volume flows. For the tested aerosol volume flows up to 5l/min no influences on the neutralization of the aerosol particles have been determined.

Figure 3: XRC integrated into U-SMPS / DEMC control unit

As the particle form and particle material can influence the ionization, different materials have been tested (e.g. graphite in figure 4). As a result the agreement between Kr-85-370 and XRC 049 was generally very good.

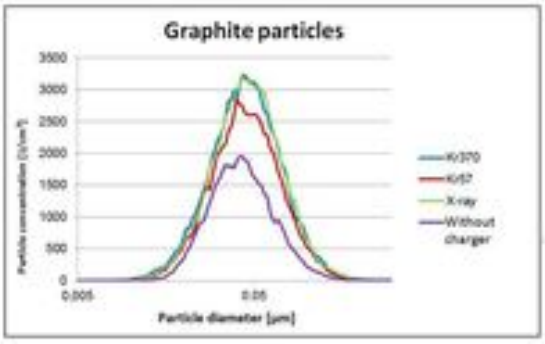

Figure 4: Measured size distribution for graphite particles

Indeed the charge distribution of the XRC 049 is neutral, whereas the charge distribution of the Kr-85-370 is shifted into negative direction. This can be seen especially at higher concentrations and shows e.g. at a concentration of 10^6 particles/cm^3 (figure 5) a difference of 7 %. This is the reason why it can be chosen with the U-SMPS/DEMC control unit (figure 3) which kind of neutralizer is being used.

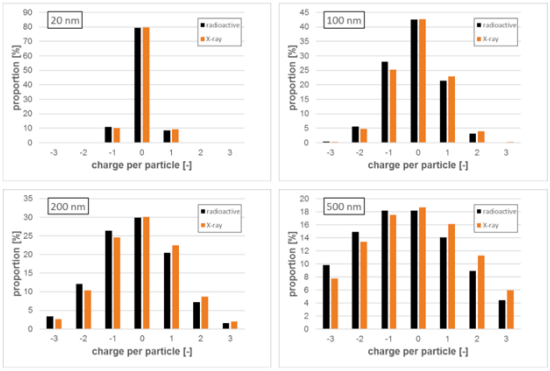

Figure 5: Comparison of size distributions measured with Kr-85 and XRC049 neutralizers

Handling

The regulations regarding X-rays are slightly different in every country. Please contact the competent authority in order to obtain more detailed information on the operation of the XRC 049. Should you

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have any questions related to this, we will be pleased to help you.

Specifications

Volume flow	Up to 5 l/min
Power supply	115 – 230 V, 50 – 60 Hz
Housing	Aluminium
Maximum particle number concentration	10^7 particles/cm^3
Carrier/dispersion gas	Air, nitrogen
Aerosol outlet connection	Øoutside = 8 mm / Øinside = 6 mm
Special features	Requires no certification in most countries
Activity of the radiator	4,9 keV
Type of radiation	γ radiation
Operation principle	Ionisation with x-rays

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