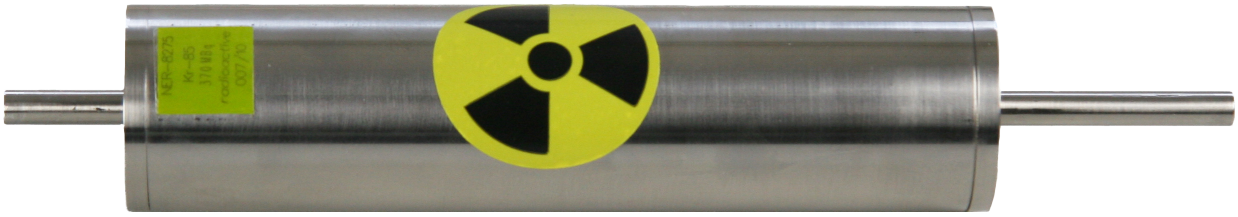
Kr-85-370



The Kr-85 Neutralizer is a bipolar neutralizer that generates positive and negative ions through ionization with the emitted β radiation. Suppose these ions are brought together with an aerosol; a defined equilibrium charge distribution is established, as is necessary for measuring systems, such as scanning mobility particle sizers (e.g., Palas U-SMPS system). This neutralizer is available in two versions with different activities, 75 MBq, and 370 MBq.

Compared to unipolar neutralization, bipolar neutralization has a significant advantage: regardless of the initial state of charge of the particles, a reproducible equilibrium charge distribution is always established. Bipolar neutralization is mandatory for traceable calibration of a condensation particle counter (e.g., ISO / CD 27891).

As the Kr-85 neutralizer is an enclosed radioactive source, additional requirements for documentation and handling regarding radiation protection should be considered. Should you have any questions, we would gladly support and advise you. Regarding the dangers of Kr-85, the following can be said: "Krypton 85 (Kr-85) is a radioactive noble gas. When released, it is practically not absorbed by the body; inhaled Kr-85 is exhaled again. [...] Kr-85 is a radioactive substance with a relatively low radiotoxicity. When Kr-85 is released, it is [generally] sufficient to provide ventilation of the working area for a short while." [KomNet scientific database dialog 6753]

Operation principle

Defined charge distribution for SMPS measurements

The Kr-85 noble gas is located inside a hermetically sealed stainless steel container integrated into a metal cylinder. The aerosol passes through the neutralizer in the space between the stainless steel container and the metal cylinder (see Fig. 1).

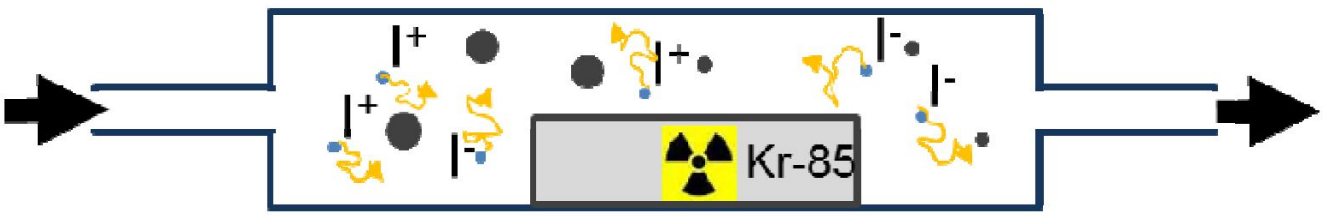


Fig. 1: Schematic of the neutralizer

Moving through the metal cylinder, the aerosol carrier gas is ionized by high-energy radioactive radiation. 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 form negatively charged ions. When, at this point, aerosol particles are exposed to this mixture of ions for a sufficient period, the charge level of the aerosol particles establishes a defined equilibrium charge distribution. To calculate this distribution, nowadays, the Wiedensohler approximation (1988) of the Gunn and Fuchs equations is used almost exclusively (see Figs. 2 and 3):

$$f(N) = 10^{\left[\sum_{i=0}^{5} a_i(N) \cdot \left(\log \frac{D_p}{nm}\right)^i\right]}$$

with: N = number of elementary charges on the particle (-1, 0, +1)

a_i = Wiedensohler coefficient

D_p particle diameter in nm

Handling and disposal

The Kr-85 neutralizer is an enclosed radioactive source. It is sent directly from the manufacturer to the customer after receipt of a handling permit and the EURATOM 1493 form.

The regulations concerning radiation protection are slightly different in every country. In Germany, radiation protection is a matter for the individual federal states. Please contact the competent authority to obtain information on the handling, storage, transport, and disposal regulations. The Palas® radiation safety officers would be pleased to help you with this question.

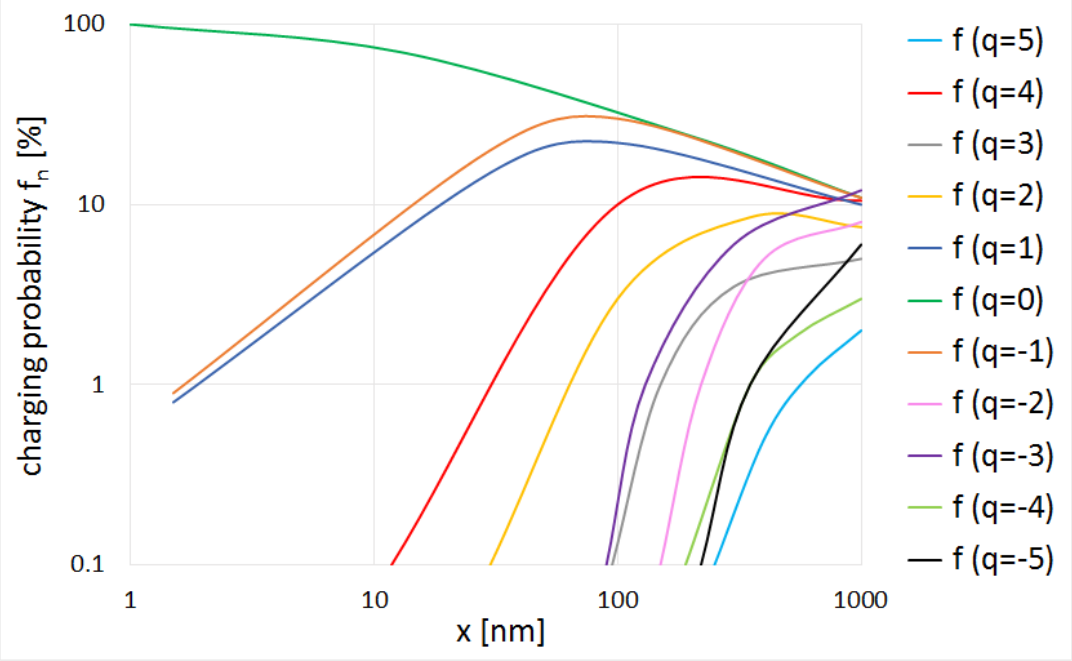


Fig. 2: Schematic of the equilibrium charge distribution established during bipolar neutralization

dp [nm]	q=-5	q=-4	q=-3	q=-2	q=-1	q=0	q=1	q=2	q=3	q=4	q=5
2					0.0083	0.9742	0.0075				
5					0.0225	0.9693	0.0189				
10					0.0514	0.9124	0.0411				
20					0.1096	0.7931	0.0846				
50				0.0114	0.2229	0.5814	0.1696	0.0066			
100		0.0001	0.0037	0.0561	0.2793	0.4259	0.2138	0.0317	0.0017		
200	0.0005	0.0053	0.0340	0.1211	0.2641	0.2991	0.2043	0.0719	0.0153	0.0018	0.0001
500	0.0207	0.0504	0.0980	0.1490	0.1816	0.1818	0.1403	0.0891	0.0440	0.0173	0.0054
1000	0.0584	0.0854	0.1113	0.1261	0.1385	0.1235	0.1039	0.0754	0.0500	0.0293	0.0154

: Table 2
Charge probability $f_q[-]$

Fig. 3: Table with selected electrical charging probabilities during bipolar neutralization

Extensions/Accessories

Upon request, Palas® offers an additional lead-lined housing free of charge, where the Kr-85 neutralizer can be put during operation. Should you be interested in a non-radioactive neutralizer, please contact us for more details and the best possible advice.

Benefits

- Zuverlässige Methode zur Einstellung einer definierten Ladungsverteilung
- Lange Lebensdauer
- Wartungsarm
- Senkt Ihre Betriebskosten

DATASHEET

Volume flow	Up to 5 l/min
Housing	Stainless steel
Aerosol outlet connection	Øinside= 4 mm, $Ø_{outside}$ = 6.5 mm
Activity of the radiator	370 MBq
Type of radiation	β-radiation
Operation principle	Ionisation of air molecules by radioactive radiation
Half-life period of the radiator	10.8 years
Aerosol inlet connection	Øinside= 4 mm, $Ø_{outside}$ = 6.5 mm
Dimensions	38.3 • 220 mm (Ø • L)
Weight	500 g

APPLICATIONS

- Neutralization for SMPS systems
- Neutralization for filter test systems
- Neutralization for diverse measuring tasks and to avoid particle losses due to electrostatic deposition

Mehr Informationen:
https://www.palas.de/en/product/kr85370