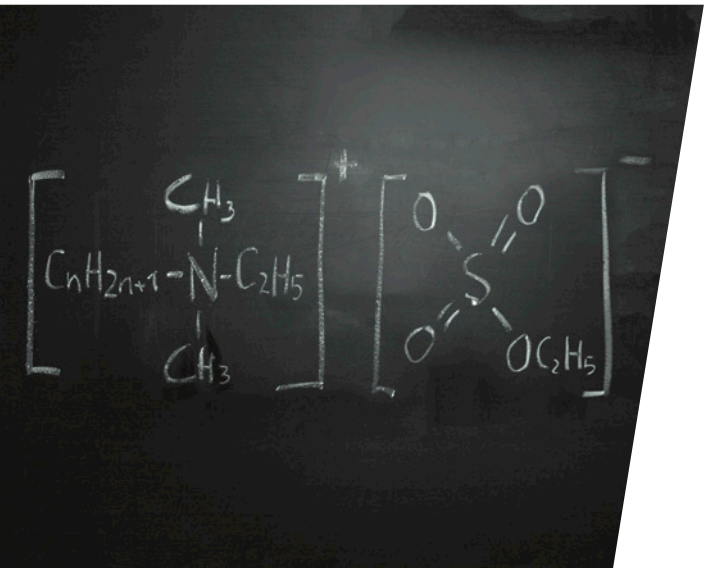
Conductivity Agents

based on quaternary ammonium compounds.



Deuteron®

ADDITIVES TO YOUR SUCCESS

/ Deuteron conductivity agents:

Additives for anti-static equipment of coatings and plastics.

Since the 1980s our product range has included our own antistatic additives for coatings and plastics. Conductivity agents and antistatic agents based on quaternary ammonium compounds have been used for various tasks and are trusted and established products in the coatings, cosmetics and biocides industries. Our Deuteron conductivity products are used for applications that range from improved spray performance of coatings to the antistatic treatment of shoe soles and floor coverings.

The buildup of electrostatic charge is caused primarily by friction between non-conductive materials. Electrons are removed from one material and deposited on the other. When the materials are separated, this electrical imbalance results in negatively and positively charged particles. The resultant electric field in the materials remains indefinitely until there is a possibility of equalising the charges.

Effects of electrostatic discharge (the equalisation of charges upon touch of two differently charged items) range from an unpleasant feel to the destruction of electronic components, the ignition of a fire or even explosions.

To prevent damage from electrostatic discharge there are a number of methods of antistatic treatment for non-conductive materials. First, static charging can be minimised by choosing a suitable material. Another approach is to modify the inherent electrostatic characteristics of a material by the use of additives. The possibilities range from metallic powder or fibres through conductive pigments (including carbon black) to quaternary ammonium compounds.

All these products can be incorporated into plastics or coatings. Correct dosing combined with the proper choice of additives enables electrostatic charging to be minimised or even eliminated. The hazards arising from electrostatic charging are thus practically averted.

	PROS	CONS
Quaternary ammonium compounds	Good value for money	Not permanently effective
	Easy to apply	Conductivity varies with humidity
	Suitable for transparent and bright systems	Toxicity
	Good compatibility	
	Liquid / Dilutable	
	Combinable with conductive fillers and fibres	
Carbon black or carbon fibers	Higher efficiency	High dosage required (perkolations PVC)
	Permanent conductivity	No linear effectiveness
		No colorless or light coloured systems possible
		Dust formation possible
Conductive pigments e.g. Sb-doped SnO2-mica	Light coloured coatings possible	High dosage required (perkolations PVC)
	Permanent conductivity	No linear effectiveness
		Dust formation possible
Nano-Tubes	Highly effective	High dosage required (perkolations PVC)
	Permanent conductivity	Difficult incorporation and mostly strong thickening effects
		Problematic properties by the nano scale particles.
		Non colourless
		Expensive
Metal powder	Good effectiveness	High dosage required (perkolations PVC)
	Permanent conductivity	

Our conductivity agents are based on quaternary ammonium compounds and are supplied in solid or liquid form. For over thirty years our antistatic agents have been used by our customers across the world in a wide range of applications: from improved spray performance of coatings to antistatic treatment for shoe soles and floor coverings. Profit from both the flexibility and the economic efficiency of our conductivity agents.

/ Advantages at a glance:

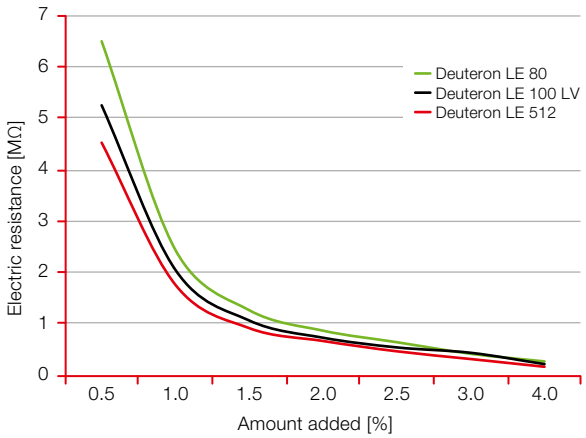
- Value for money / profitable.
- Easy to work with at room temperature (supplied in liquid form).
- Easy to dilute.
- Suitable for colourless and light-coloured systems.
- Good compatibility.
- Can be combined with many other fillers and fibres.

All additives that we supply have particular advantages and disadvantages. For each specific application, consideration should be given as to which compromises are acceptable in order for the visual, economic and, above all, the functional requirements to be satisfied. There is thus no single “perfect” additive, but rather only the “most suitable” additive.

/ Resistance measurement

In order to find the correct solution for your requirements, simple experimental systems can be set up at the development stage to determine the volume and surface resistances by means of a series of comparative measurements.

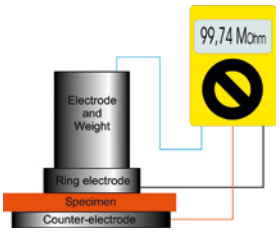
To perform the measurements all that is required is a suitable resistance meter and suitable electrodes for measuring volume and surface resistance. Suitable measurement devices, which also allows measurement at variable voltage, are for example the Metriso C or Metriso 2000 from Gossen-Metrawatt GmbH.



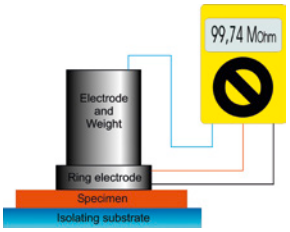
Comparision of the conductivity at different concentrations.

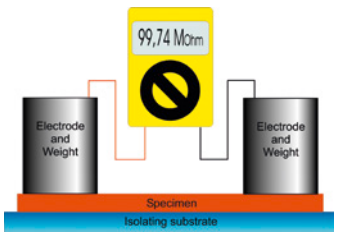
The following standards for the measurement of antistatic surfaces apply:

- Surface resistance R_S: IEC 61340-2-3, IEC 61340-5-1, ESD STM 1.11, ASTM-D257 VDE 0300 part 5-1 / 2-3
- Point-to-point surface resistance R_{pp}: IEC 61340-2-3, IEC 61340-5-1
- Resistance to ground R_E: IEC 61340-2-3, IEC 61340-4-1, EN 1081
- Volume resistance ρ_V: IEC 61340-2-3, VDE 0300 part 2-3, EN 14041



Measurement of volume resistance.

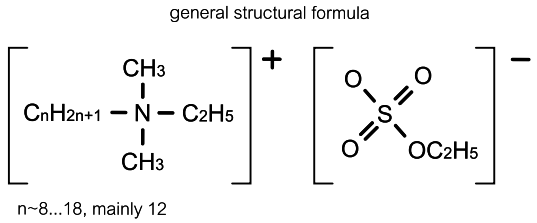




Measurements of surface resistances.

/ Conductivity agents from Deuteron:

Quaternary ammonium compounds contain quaternary nitrogen atoms, that means every four hydrogen atoms in the ammonium ions are replaced by organic components. Our conductivity agents are amine type NR4+X– salts. These substances are cationic surfactants with a long alkyl group which, because of its permanent positive charge, strongly adsorbs on surfaces and particles. The products of the Deuteron LE-series are based on tetraalkylammonium ethyl sulphate. They are water soluble and soluble in polar solvents but not soluble in nonpolar organic solvents. The following theory explains the effects of Quats as antistatic agents. The substances migrate partially to the surface. The active molecules are oriented in a way that the hydrophilic groups protrude from the polymer surface. A conductive layer builds up by absorbing water from the air due to the polar groups of the antistatic agent, which is increasing the wettability and usually acting hygroscopically. Under normal atmospheric humidity, the conductivity is sufficient, e.g. To prevent dusting by electrostatic attraction.

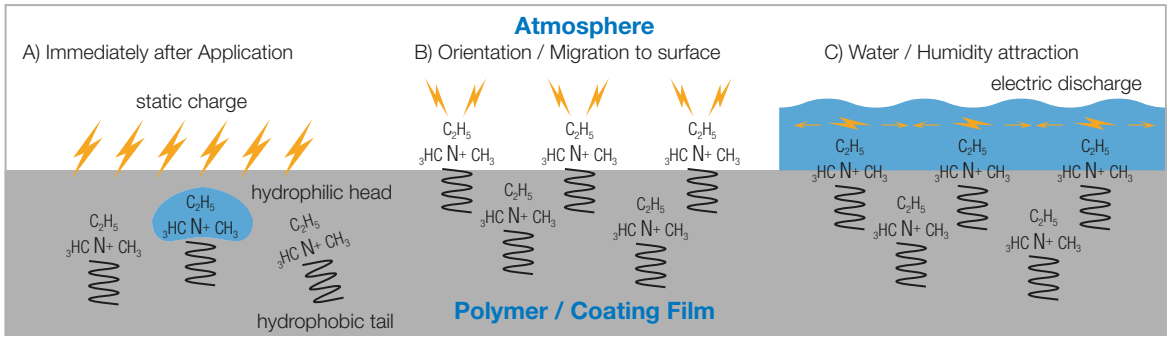


Structure of a quarternary ammonium compound.

Restrictions of use: Quaternary ammonium salts create conductive surfaces. But they are not conductive substances! In the case of requirements such as low surface resistances even in dry air or desired values below 100 MΩ, combinations of different antistatic additives need to be used that evince a proper conductivity that is independent of humidity.

Due to the fact that these substances are capable of migrating, it must be assumed that, depending on the overall system, the effect is potentially non-permanent. This differs in every system and must be checked based on the specific regulations that apply.

In epoxy resin coatings, conductivity agents based on quaternary ammonium compounds are usually ineffective as a sole additive. Instead, a combination of conductive pigments or carbon fibres is suggested. Other limitations arise in aliphatic preparations.



Schematic description of the effect of quarternary ammonium compounds.

For example, the anti-static preparation of mineral oils or lubricants is mostly impossible. Such systems tend to separate relatively quickly due to insolubility. Quats are neither perfectly soluble in aromatic systems; however the products are emulsified in finest drops, which leads to opalescence of the preparation.

Preperation: With the exception of Deuteron LE 512 the conductivity additives can be incorporated into the system that needs the antistatic treatment in their delivered form at room temperature or even lower without difficulty and without heating. Deuteron LE 512 needs to be molten before use to provide a homogenous distribution. A special product is our Deuteron LE 100 LV, which is liquid at room temperature with 100 % active content and free of solvents.

	LE 80	LE 50*	LE 50 UV*	LE 151	LE 829	LE 100LV	LE 512	
Active content	80	50	51	82	82	100	100	%
Solvent	Butanol	Butanol	DPGDA	1.2-Ethandiol	1.4-Butandiol	-	-	
Delivered as	liquid	liquid	liquid	liquid	liquid	liquid	solid	
Viscosity	150	20	150	300	400	3500	-	mPas
Melting point approx.	-	-	-	-	-	-	88	°C
Density approx.	0.94	0.89	1.05	0.99	0.98	1.05	0.96	
Acid value approx.	3.3	2.6	7	<7	<7	13	3	
pH-value (1 % in water) approx.	8	7.5	-	8	8	8.5	7.5	

*= Low dosage version of Deuteron LE 80 with less critical labeling.

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ADDITIVES TO YOUR SUCCESS

/ Deuteron: First-class products for the coatings industry

DEUTERON GmbH has 30 years of experience in the production and sales of additives including: matting agents, conductivity agents and UV initiators. In the course of our company's 30-year history, we have become an important partner for the paint, lacquer and coatings industry – we operate nationally and internationally and are represented all over the globe. We serve you with the dependability and close business relationship that only an owner-operated, medium-sized company can offer – and we also have the expertise of a global provider. Get in touch with us! We are happy to be of assistance and to help find individual solutions for your needs.

/ Visit us on the Internet

You can find detailed information on all our products at www.deuteron.com. Matting and texturing agents, surface additives, UV initiators and much, much more: We supply first-class products and look back on more than 30 years of experience as an important partner for the coatings industry.

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