

Antistatic Spiral Fabrics

... Production

... Development

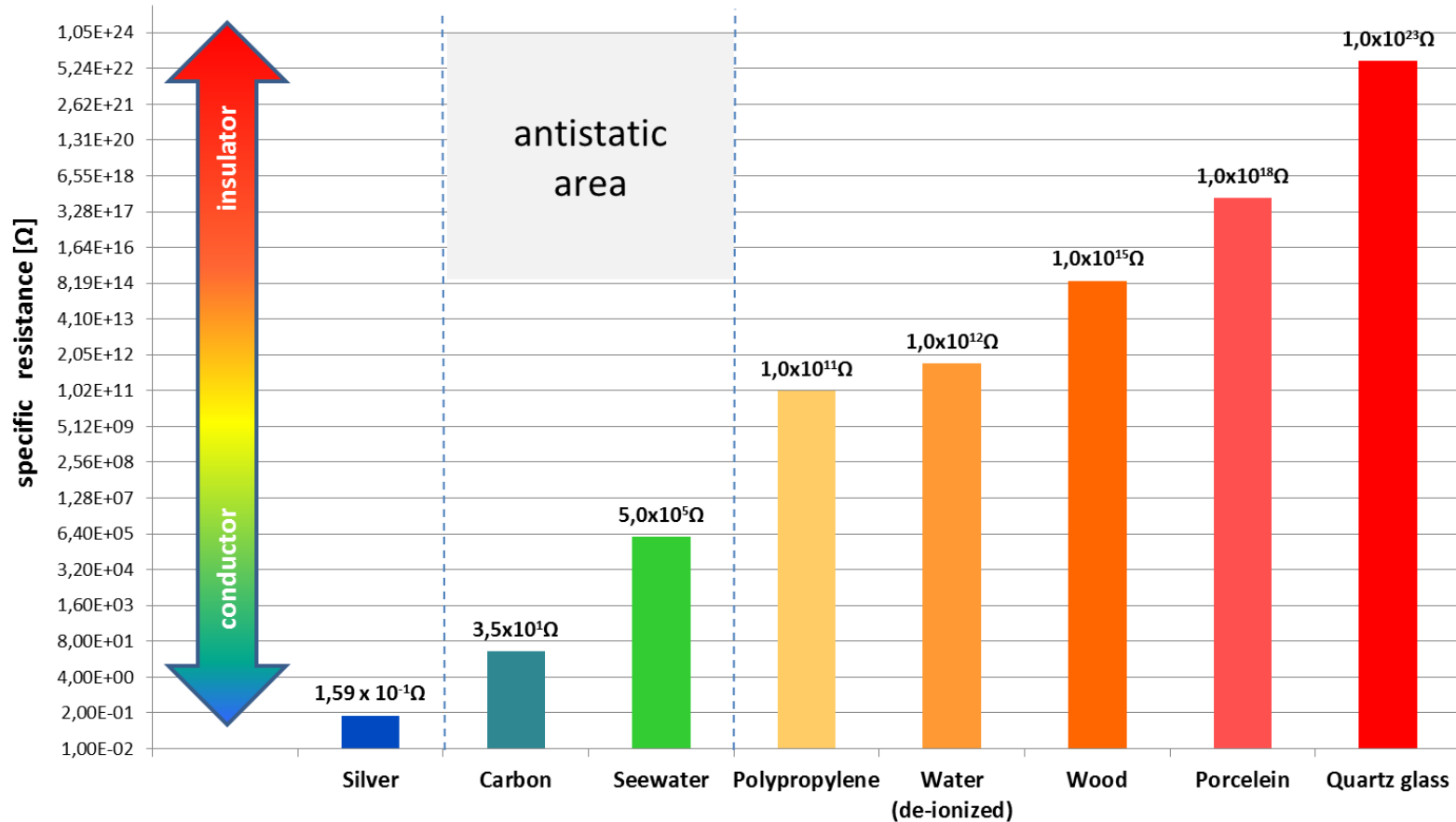
... Designs

... Application



Antistatic Spiral Fabrics

Examples of specific resistance

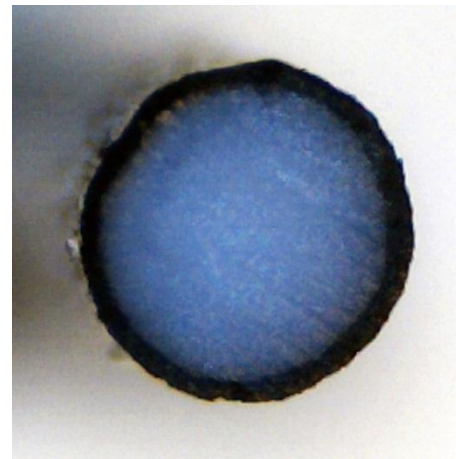


Antistatic Spiral Fabrics

Antistatic spirals are made of bicomponent monofilaments.

“Shell” and “Core” of these monofilaments consist of the same or similar polymer, however the shell polymer is physically modified for electrical conductivity.

The chemical relationship, as well as the production process of the filaments in one process step, guarantees maximum possible adhesion between the two components.

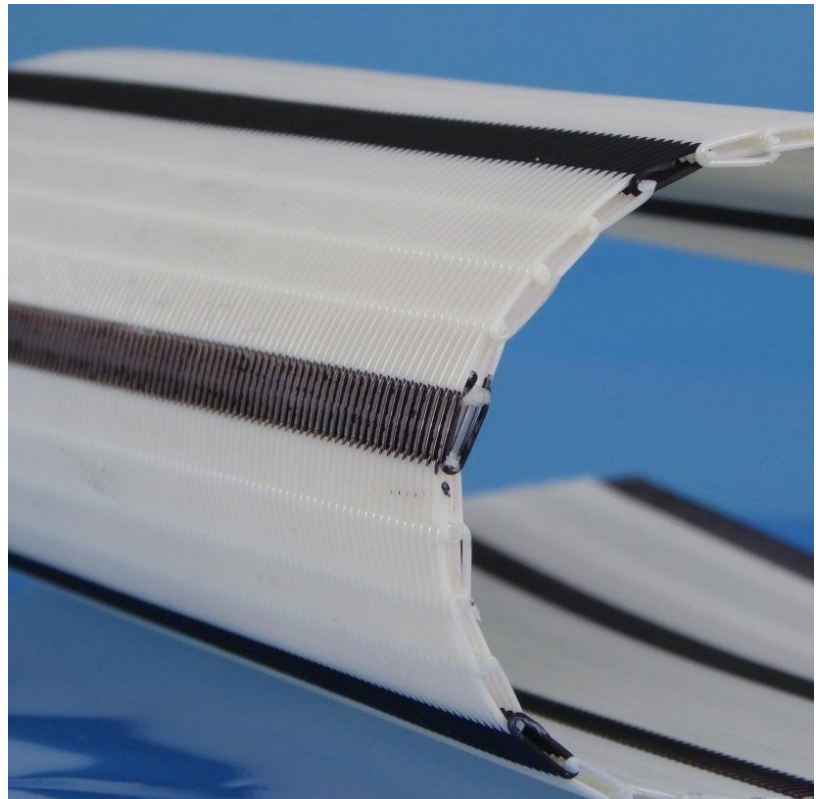


Antistatic Spiral Fabrics

Manufacturing:

Antistatic spiral fabrics are produced with spirals made from an antistatic polymer.

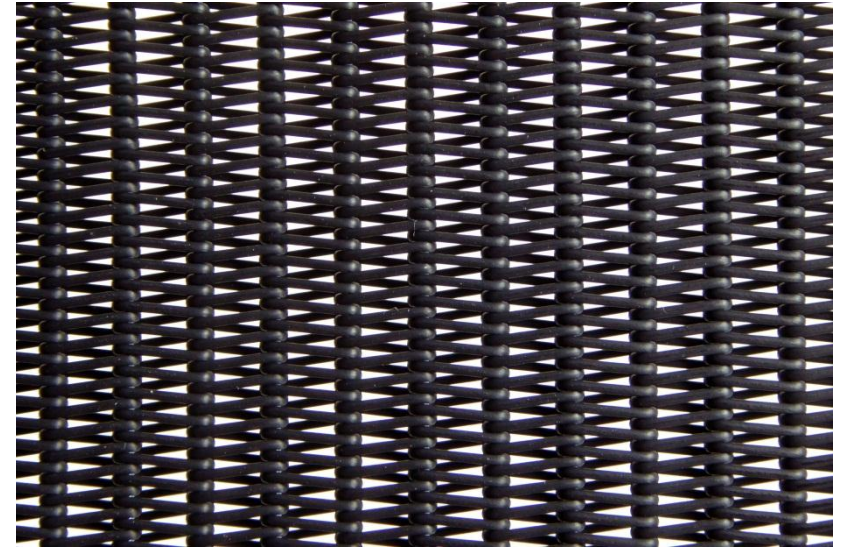
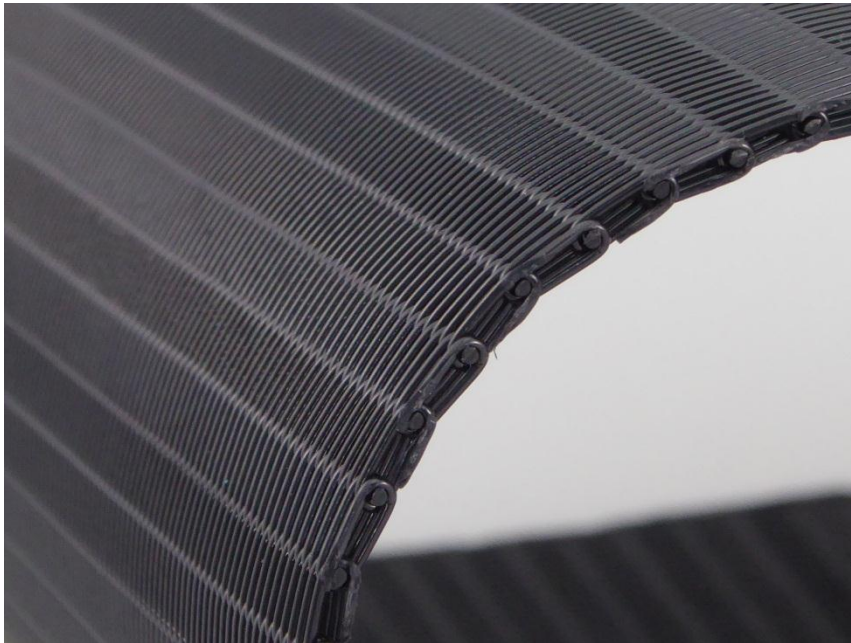
Possible designs either have antistatic spirals alternating with standard spirals, or 100% antistatic spirals only.



Antistatic Spiral Fabrics

Spiral types made with antistatic spirals:

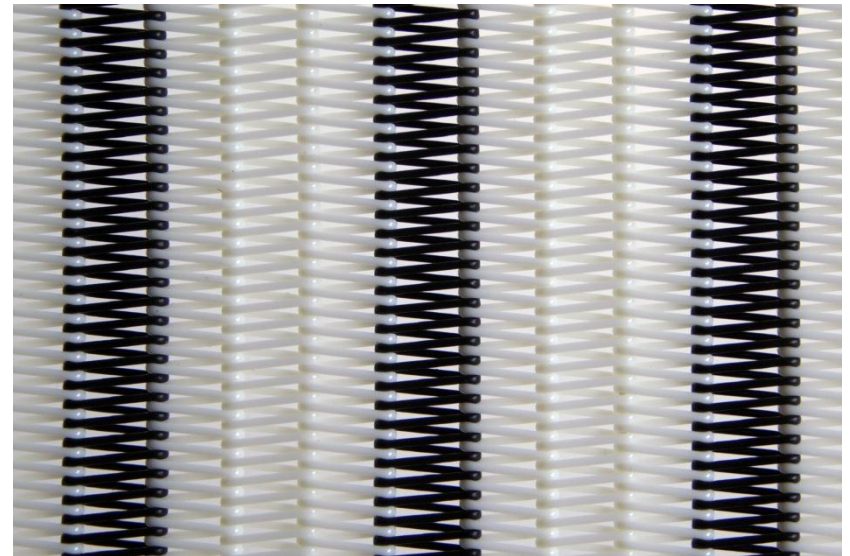
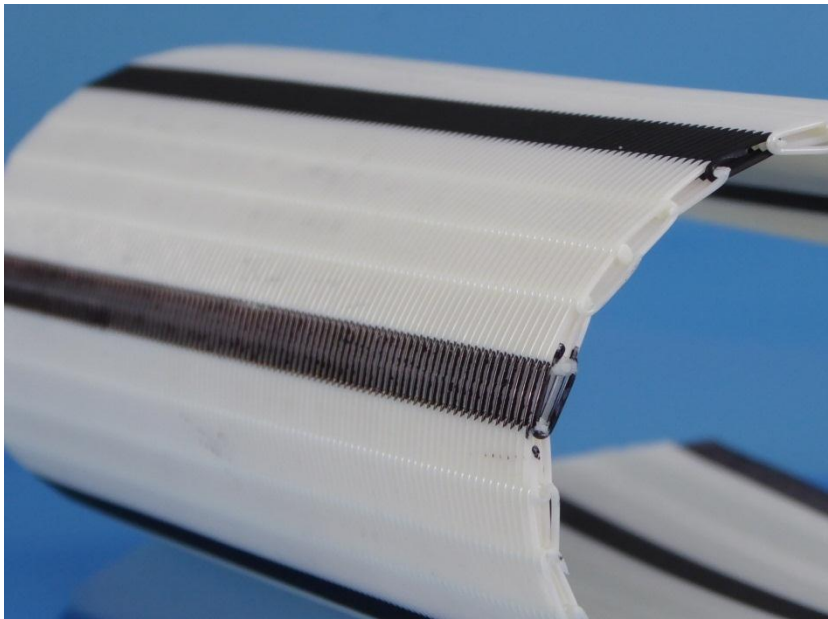
Spiral fabrics made of 100% antistatic spirals



Antistatic Spiral Fabrics

Spiral types made with antistatic spirals:

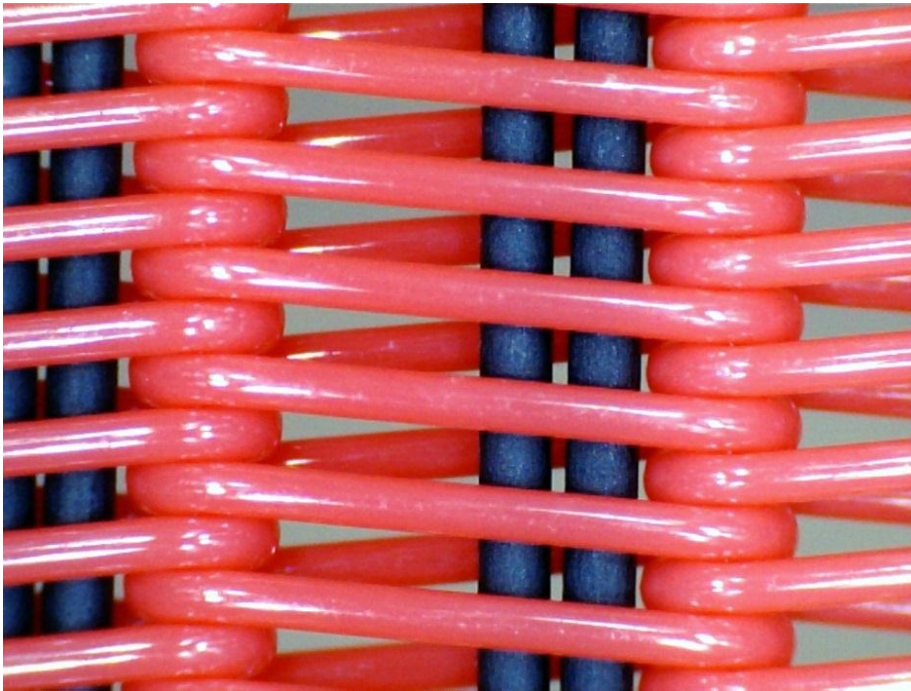
2.) Spiral fabrics produced with antistatic spirals in regular succession ...



... depending on design, this can
e.g. be every 4th, 5th or 10th spiral



Antistatic Spiral Fabrics



3.) ... a further design of an antistatic spiral fabric shows antistatic fillers inside the spiral channel.

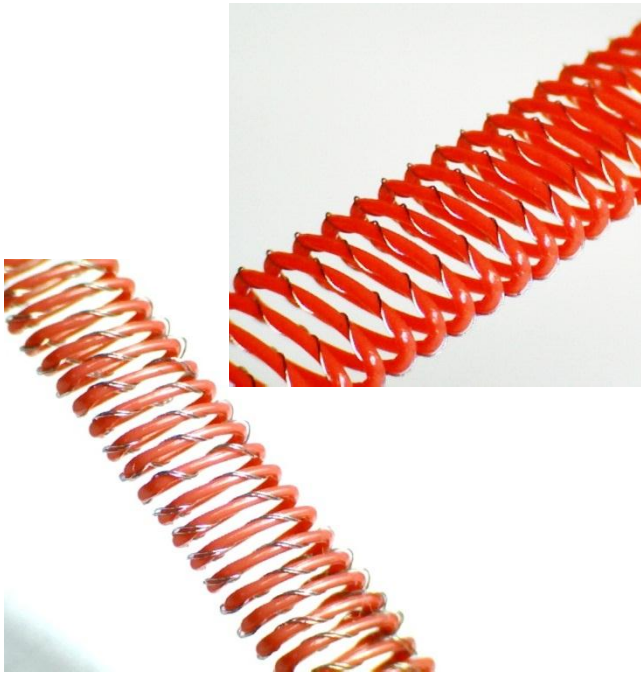
These fabrics have an edge reinforcement which also has antistatic properties. The idea behind such construction is the transportation of charges from the fabric through the fillers to the edge dope and from there to the steel roll.



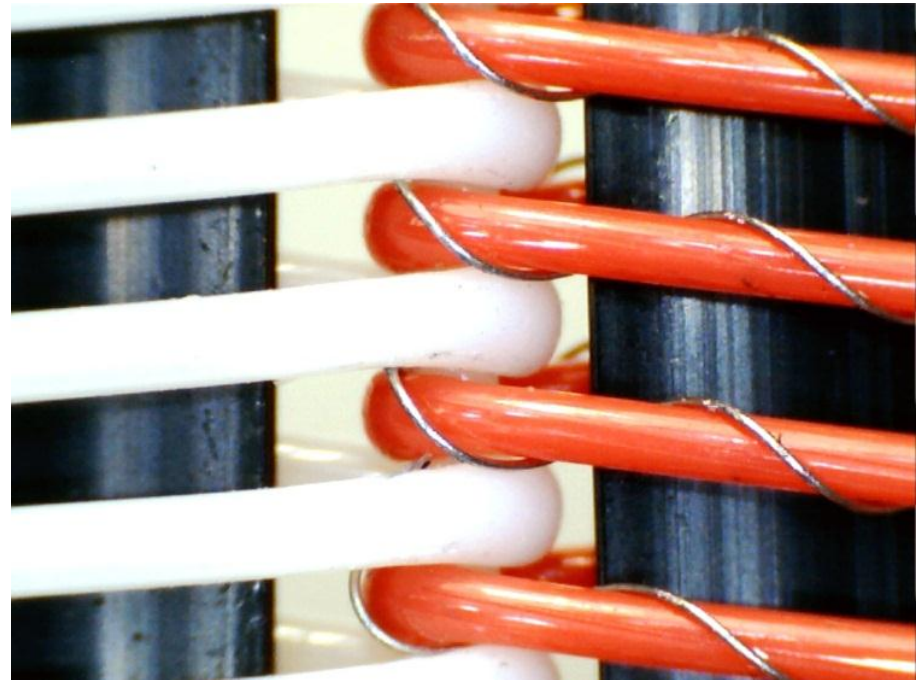
Antistatic Spiral Fabrics

4.) ... based on metal-strand twisted spirals:

Single-yarn twisted ...



... twin-yarn twisted



... discharging by metal based conductivity



Antistatic Spiral Fabrics

Analyses and certificates were made by the
Institute of Textile Technology and Process Engineering - ITV Denkendorf
accredited to the norm **DIN EN ISO/IEC 17025:2005**

Institute of Textile Technology and Process Engineering Denkendorf
Laboratory for Technical Textiles



Table 1 / 2 of order E-0181-TT-13

Table 1/2: Electrical resistance of a spiral fabric

Customer: Württembergische Spiralsiebfabrik

Date: 21.08.2013

Order No.: E-0181-TT-13

Climatic Condition: 23 ± 2°C / 25 ± 5 % r.F.

Parameter	Test-conditions	Characteristic Values	Unit	Spiral fabric C							
				cross direction with edge contact; edge bonding to spiral		length direction along edge bonding ¹⁾		length direction ²⁾		cross direction without edge contact ³⁾	
Point-to-point-resistance ¹⁾ DIN EN 61340-5-1	Distance of electrodes		cm	30	10	30	10	30	10	30	10
		x ₁	Ohm	1,2 · 10 ⁷	1,2 · 10 ⁶	2,7 · 10 ¹⁰	7,5 · 10 ⁹	3,0 · 10 ¹⁰	4,9 · 10 ⁹	5,1 · 10 ⁹	2,0 · 10 ⁹
		x ₂	Ohm	4,9 · 10 ⁵	1,0 · 10 ⁶	2,9 · 10 ¹⁰	6,4 · 10 ⁹	2,7 · 10 ¹⁰	6,5 · 10 ⁹	3,2 · 10 ⁹	6,6 · 10 ⁵
		x ₃	Ohm	4,8 · 10 ⁵	1,3 · 10 ⁶	2,4 · 10 ¹⁰	2,3 · 10 ⁹	2,3 · 10 ¹⁰	7,4 · 10 ⁹	4,3 · 10 ⁹	1,1 · 10 ⁶
		x ₄	Ohm	5,6 · 10 ⁵	1,3 · 10 ⁶	1,2 · 10 ¹⁰	2,5 · 10 ⁹	2,7 · 10 ¹⁰	7,9 · 10 ⁹	3,2 · 10 ⁹	9,4 · 10 ⁵
		x ₅	Ohm	8,9 · 10 ⁵	9,9 · 10 ⁵	1,0 · 10 ¹⁰	2,4 · 10 ⁹	2,5 · 10 ¹⁰	8,1 · 10 ⁹	1,3 · 10 ⁹	1,6 · 10 ⁶
		$\bar{x}$	Ohm	7,2 · 10 ⁵	1,2 · 10 ⁶	2,0 · 10 ¹⁰	4,2 · 10 ⁹	2,6 · 10 ¹⁰	7,0 · 10 ⁹	5,8 · 10 ⁹	1,3 · 10 ⁶

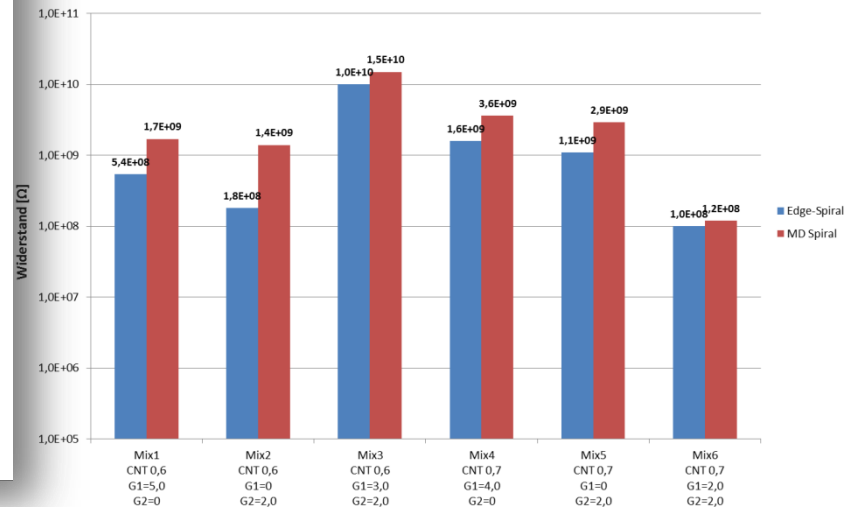
¹⁾ point electrode: diameter: 63 mm; weight: 2,27 kg

²⁾ both electrodes contact the edge bonding and no spirals

³⁾ the electrodes contact different black spirals

⁴⁾ the electrodes contact the same spirals

Elektrischer Widerstand [Ω] / A = 10 cm

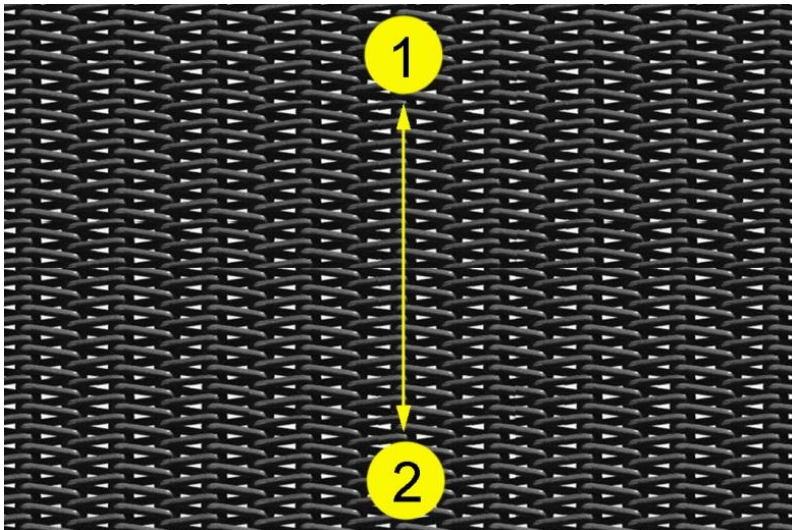


Antistatic Spiral Fabrics

Measurements of spiral fabrics made of 100% antistatic material

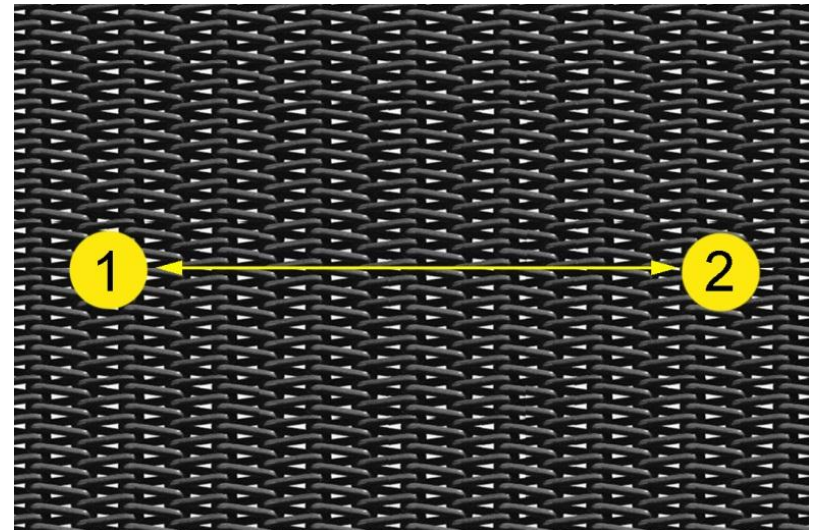
Design 55000 A and 70000 A

Measurements in cross direction (CD)



Electrical resistance [Ω]: $2,0 \times 10^5$

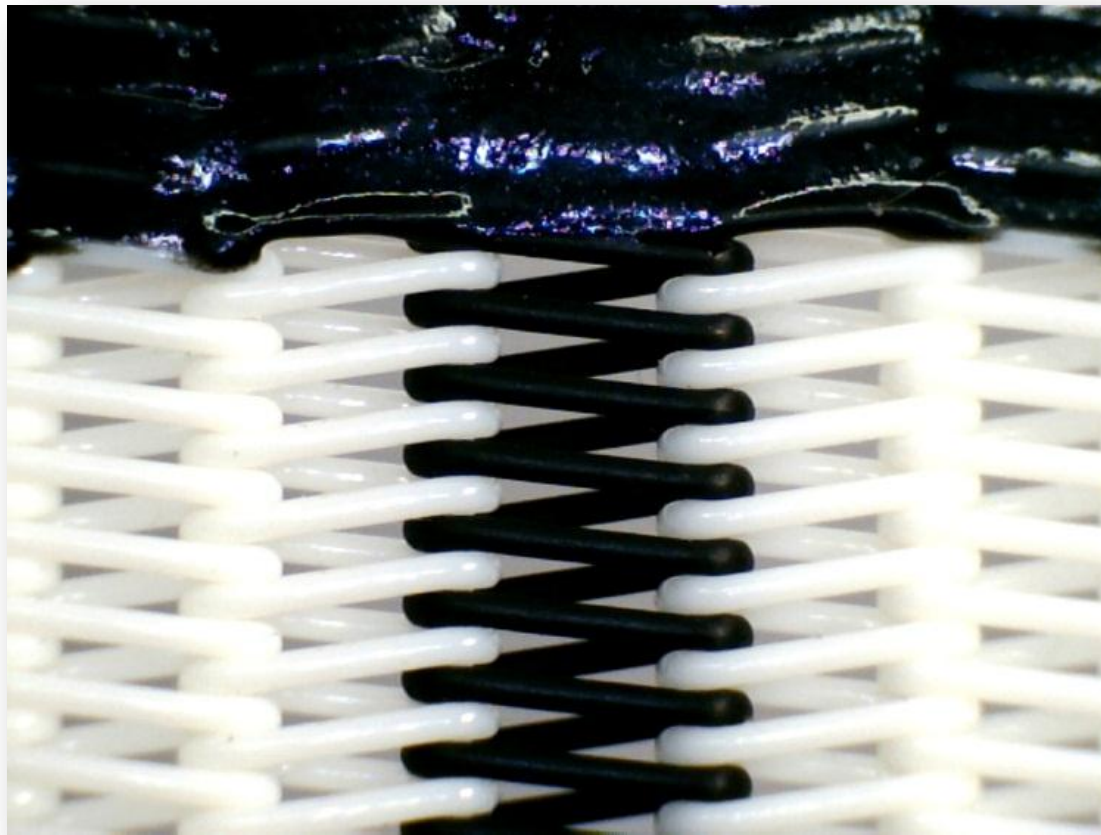
Measurements in machine direction (MD)



Electrical resistance [Ω]: $8,0 \times 10^5$

Antistatic Spiral Fabrics

Development of the antistatic WSF edge reinforcement



Antistatic Spiral Fabrics

WSF – reinforcement for antistatic spiral fabric edges

Components of mixture

- Polyol
- Isocyanate
- Graphite modification
- Carbon nanotubes

of the WSF edge dope for antistatic spiral fabrics are adjusted to achieve an optimal compatibility of

- mechanical properties
- electrical conductivity
- and workability



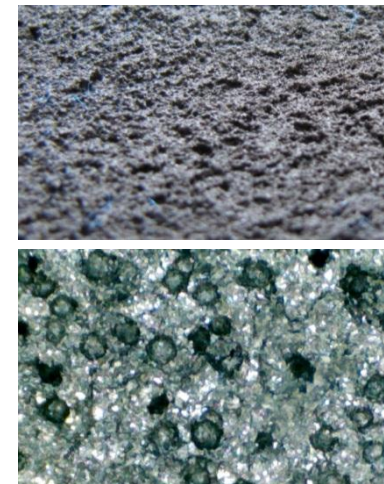
Antistatic Spiral Fabrics

Test series with CNT und graphite modifications in different mix ratios,
in co-operation with the company FutureCarbon

Samples in different mix ratios:



Surface structure:



Confidential information exchange between the co-operation partners

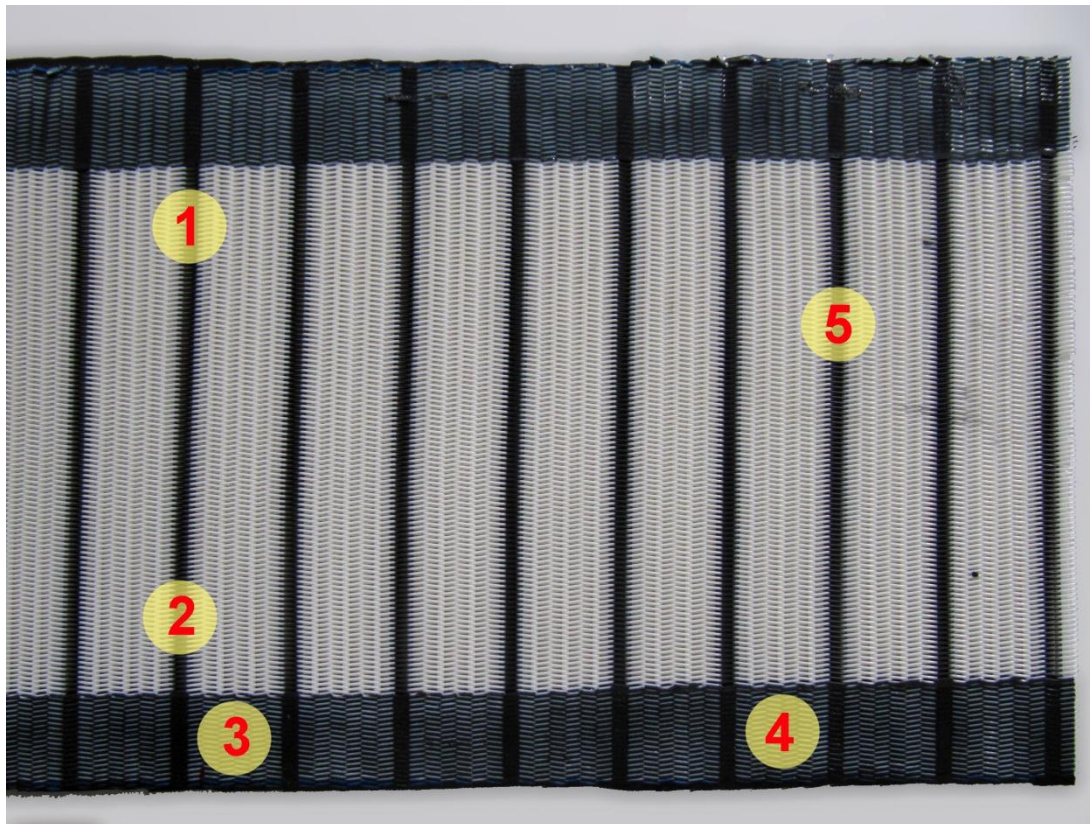
:FutureCarbon
Material Innovations in Composites

← Confidential Agreement →

 solution in spirals
Württembergische
Spiralsiebfabrik GmbH

Antistatic Spiral Fabrics

Electrical resistance in a spiral fabric made of alternating regular and antistatic spirals, with antistatic edge reinforcement



Electrical resistance
between measuring
points

$$\textcircled{1} \rightarrow \textcircled{2} = 1,3 \times 10^6 \Omega$$

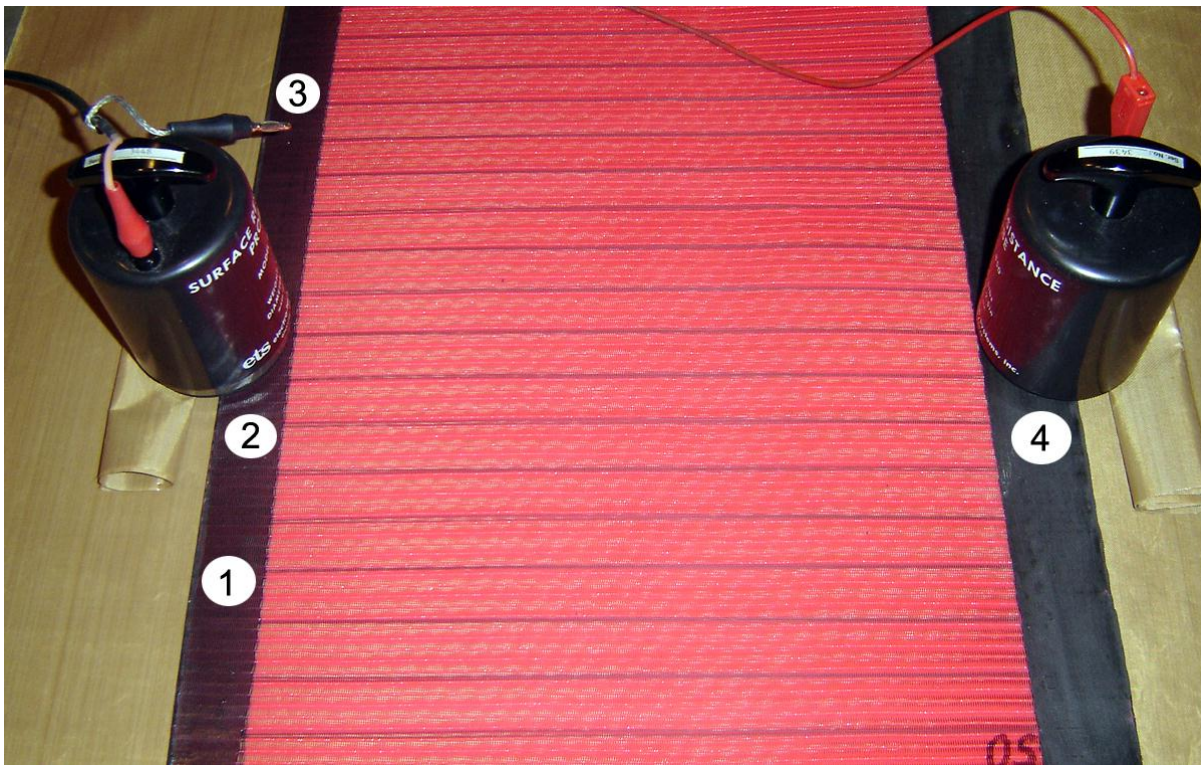
$$\textcircled{2} \rightarrow \textcircled{3} = 7,2 \times 10^6 \Omega$$

$$\textcircled{3} \rightarrow \textcircled{4} = 4,2 \times 10^6 \Omega$$

$$\textcircled{1} \rightarrow \textcircled{5} = 7,0 \times 10^6 \Omega$$

Antistatic Spiral Fabrics

Electrical resistance in spiral fabrics with antistatic filler:



Electrical resistance
between measuring
points:

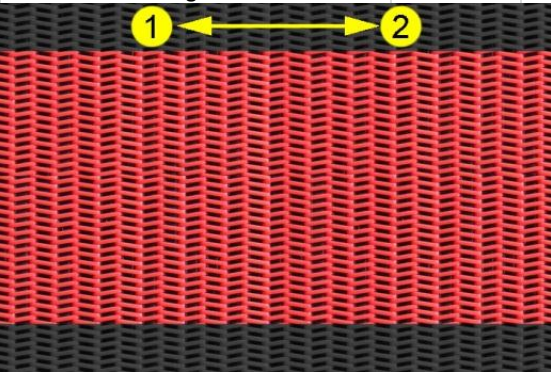
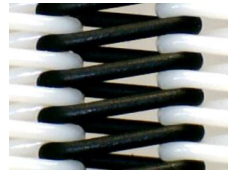
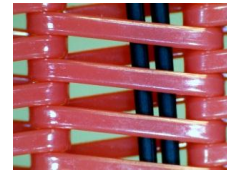
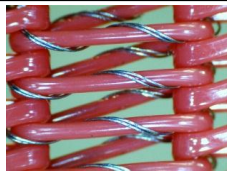
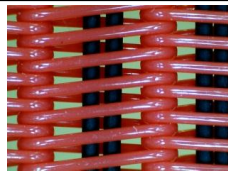
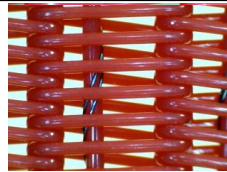
$$\textcircled{1} \rightarrow \textcircled{2} = 4,6 \times 10^8 \Omega$$

$$\textcircled{1} \rightarrow \textcircled{3} = 6,7 \times 10^8 \Omega$$

$$\textcircled{1} \rightarrow \textcircled{4} = 1,2 \times 10^{10} \Omega$$

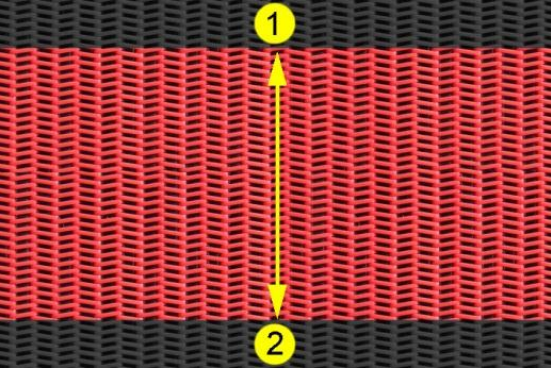
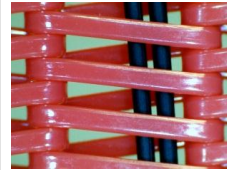
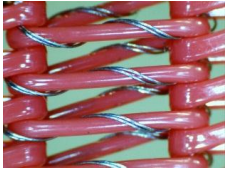
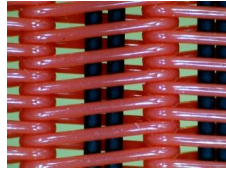
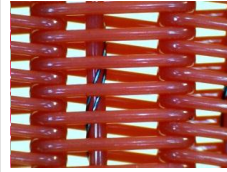
Antistatic Spiral Fabrics

Electrical resistance within the edge

Measurement: Edge - Distance 10 cm									
					Type	ITV 01.12.2016 55000 A	ITV 04.08.2016 55000 S A-5	ITV 21.08.2013 70000 S7L A-5	ITV 28.11.2016 43800 FSL F2A
					Picture				
					electrical resistance [Ω]	2×10^9	$1,7 \times 10^8$	$4,2 \times 10^9$	$1,5 \times 10^{11}$
					Type	ITV 28.11.2016 43800 FSL F1M	ITV 28.11.2016 43000 FSL M6	ITV 28.11.2016 40700 S F2A	ITV 28.11.2016 40800 S F1M
					Picture				
					electrical resistance [Ω]	$1,7 \times 10^{10}$	$4,4 \times 10^9$	$2,8 \times 10^{10}$	$3,5 \times 10^9$

Antistatic Spiral Fabrics

Electrical resistance from edge to edge

Measurement: Edge to edge (exactly opposite)									
					Type	ITV 01.12.2016 55000 A	ITV 04.08.2016 55000 S A-5	ITV 21.08.2013 43800 FSL F2A	ITV 28.11.2016 43800 FSL F2A
					Picture				
					electrical resistance [Ω]	5×10^9	$1,6 \times 10^{10}$	$4,2 \times 10^9$	$8,5 \times 10^{10}$
					Type	ITV 28.11.2016 43800 FSL F1M	ITV 28.11.2016 43000 FSL M6	ITV 28.11.2016 40700 S F2A	ITV 28.11.2016 40800 S F1M
					Picture				
					electrical resistance [Ω]	$1,1 \times 10^{10}$	$2,0 \times 10^3 *$	$2,0 \times 10^{11}$	$3,9 \times 10^8$
						* possible contact of electrodes to metal helix			

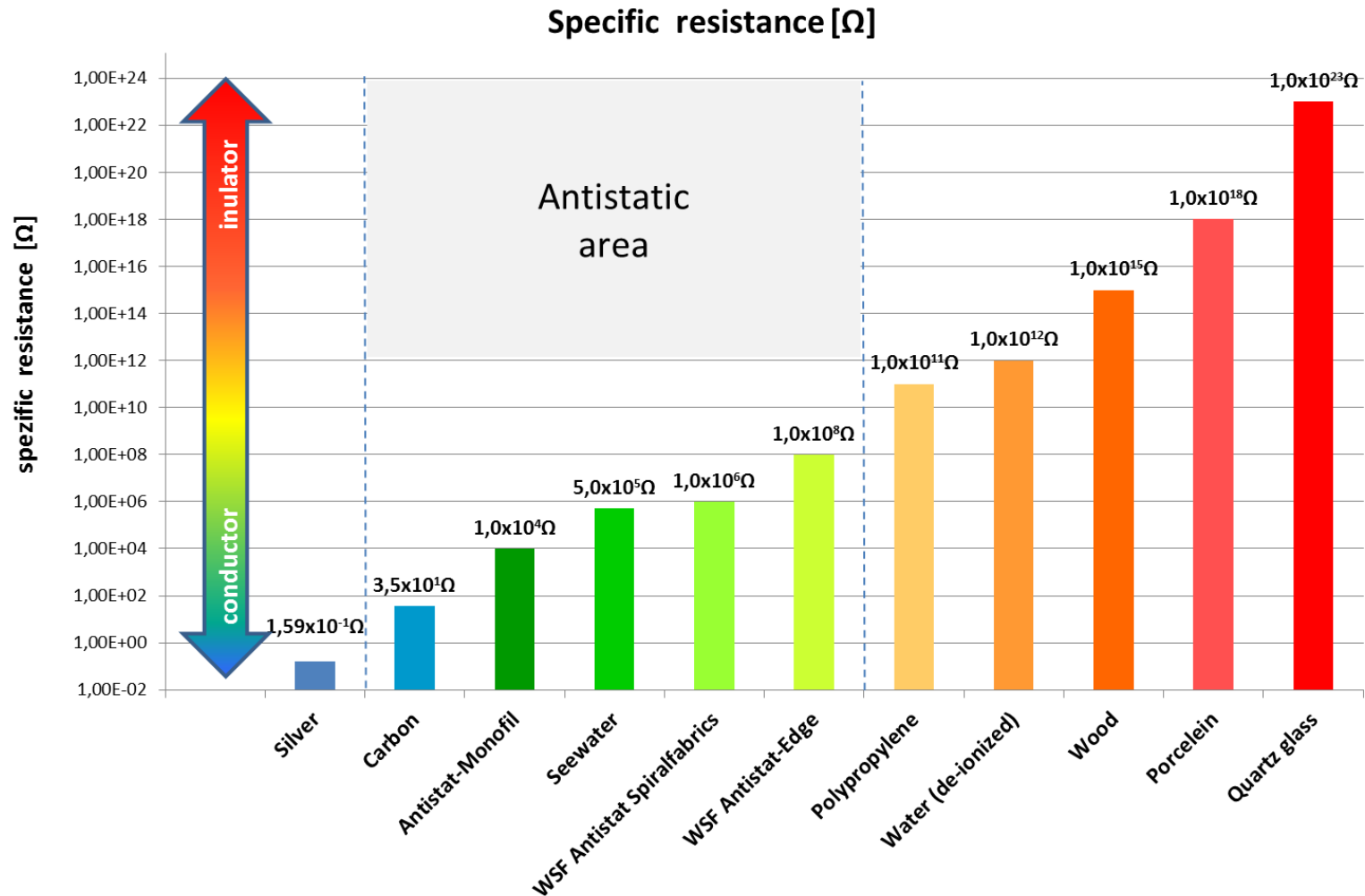


Antistatic Spiral Fabrics

Electrical resistance from edge to edge with additional offset

Measurement: Edge to edge with 10 cm offset											
							Type	ITV 01.12.2016 55000 A	ITV 04.08.2016 55000 S A-5	ITV 21.08.2016 43800 FSL F2A	ITV 28.11.2016 43800 FSL F2A
							Picture	 	 	 	
							electrical resistance [Ω]	1×10^{10}	kM	$2,6 \times 10^{10}$	$1,6 \times 10^{10}$
								ITV 28.11.2016 43800 FSL F1M	ITV 28.11.2016 43000 FSL M6	ITV 28.11.2016 40700 S F2A	ITV 28.11.2016 40800 S F1M
							Picture	 	 	 	
							electrical resistance [Ω]	$9,5 \times 10^9$	$3,6 \times 10^9$	$1,0 \times 10^{11}$	$6,9 \times 10^9$

Antistatic Spiral Fabrics



Antistatic Spiral Fabrics

Electrostatic charge

Definition: In a neutral, non-charged body the number of electrons and protons is identical. The body can be positively or negatively charged by transfer of electrons, meaning release or intake of electrons.

The charge can be generated by

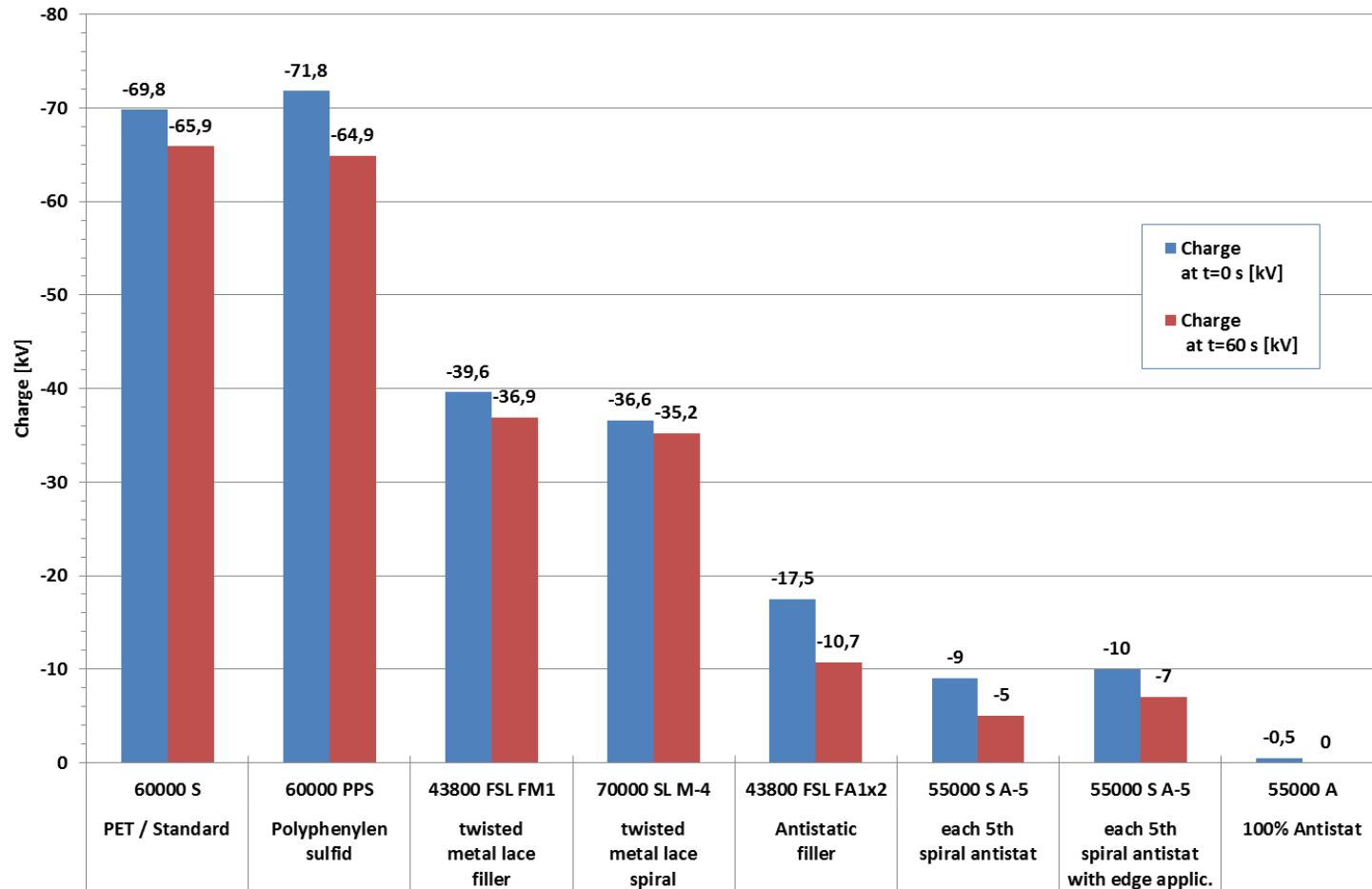
- friction
- electrical charge
- electric induction

To imitate an application in the nonwovens industry, a spiral fabric is charged by corona electrode with the intention of analyzing its electrostatic behaviour.



Antistatic Spiral Fabrics

Charging of spiral fabrics with a corona electrode



Antistatic Spiral Fabrics

Electrostatic Charge

Practical comparison of different spiral fabrics

- Video 1: A standard spiral fabric is charged by a corona electrode and tested for electrostatic attraction force towards PP fibers
- Video 1: A partially antistatic spiral fabric is charged by a corona electrode and tested for electrostatic attraction force towards PP fibers
- Video 1: A totally antistatic spiral fabric is charged by a corona electrode and tested for electrostatic attraction force towards PP fibers



Antistatic Spiral Fabrics



Antistatic Spiral Fabrics



Antistatic Spiral Fabrics



Antistatic Spiral Fabrics

Designs / Extract from the portfolio:

Qualität PET Antistatisch <i>Spezial Rundspiralen</i>			Qualität PET Metallummantelt <i>Spezial Rundspirale</i>						
Spiralsolution	70000 A		Spiralsolution	70000 S7L M-5					
			Spiralsolution	70000 S7L M-10					
Spiralsolution	70000 S7 A-5								
Spiralsolution	70000 S7 A-10								
Spiralsolution	70000 S7L A-5								
Spiralsolution	70000 S7L A-10								
Spiralsolution	70250 S7L A-5								
Spiralsolution	70250 S7L A-10								
Spiralsolution	70400 S7L A-5								
Spiralsolution	70400 S7L A-10								
Spiralsolution	70600 S7L A-5								
Spiralsolution	70600 S7L A-10								



Antistatic Spiral Fabrics

... and examples of data sheets:

Spiralsolution 70000 A

Datenblatt (thermoformiertes Sieb)



Technische Daten

Luftdurchlässigkeit:	(cfm)	900
Flächengewicht:	(g/m²)	1310
Dicke:	(mm)	2,30
Teilung:	(m-1)	191
Ø Monofil Spirale:	PET antistatic	0,70
Ø Monofil Steckdraht:	PET	0,60
Abmessung Fülldraht:	xxx	xxx



Eigenschaften und Einsatzbereiche

- Antistatisch
- Leicht zu schließen
- Stabile Laufeigenschaften
- Elektrostatisch gefährdete Positionen
- Karton / Verpackung / Zellstoff Trockensieb

Württembergische Spiralsieb- & Siebtechnik GmbH
70372 Stuttgart · Telefon
07141 300-1000
Telefax 07141 300-1001
E-Mail: info@spiralsieb.de
Internet: www.spiralsieb.de

Spiralsolution 70000 STL A-5

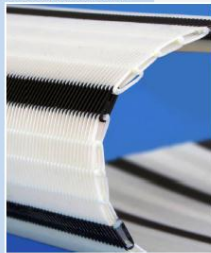
Datenblatt (thermoformiertes Sieb)



Technische Daten

Luftdurchlässigkeit:	(cfm)	950
Flächengewicht:	(g/m²)	1190
Dicke:	(mm)	2,30
Teilung:	(m-1)	191
Ø Monofil Spirale:	PET / PET antistatic*	0,70
Ø Monofil Steckdraht:	PET	0,70
Abmessung Fülldraht:	xxx	xxx

* jede 5. Spirale antistatisches Monofil



Eigenschaften und Einsatzbereiche

- Antistatisch
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Württembergische Spiralsieb- & Siebtechnik GmbH
70372 Stuttgart · Telefon
07141 300-1000
Telefax 07141 300-1001
E-Mail: info@spiralsieb.de
Internet: www.spiralsieb.de

Spiralsolution 70250 STL A-10

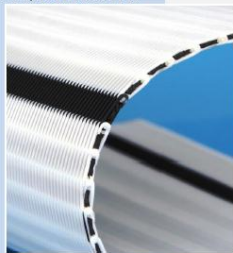
Datenblatt (thermoformiertes Sieb)



Technische Daten

Luftdurchlässigkeit:	(cfm)	250
Flächengewicht:	(g/m²)	1720
Dicke:	(mm)	2,30
Teilung:	(m-1)	191
Ø Monofil Spirale:	PET / PET antistatic*	0,70
Ø Monofil Steckdraht:	PET	0,70
Abmessung Fülldraht:	PET / P40.1	3,80 x 0,93

* jede 10. Spirale antistatisches Monofil



Eigenschaften und Einsatzbereiche

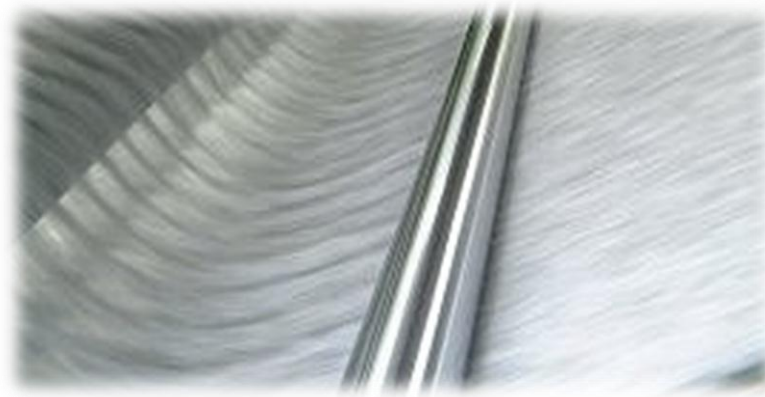
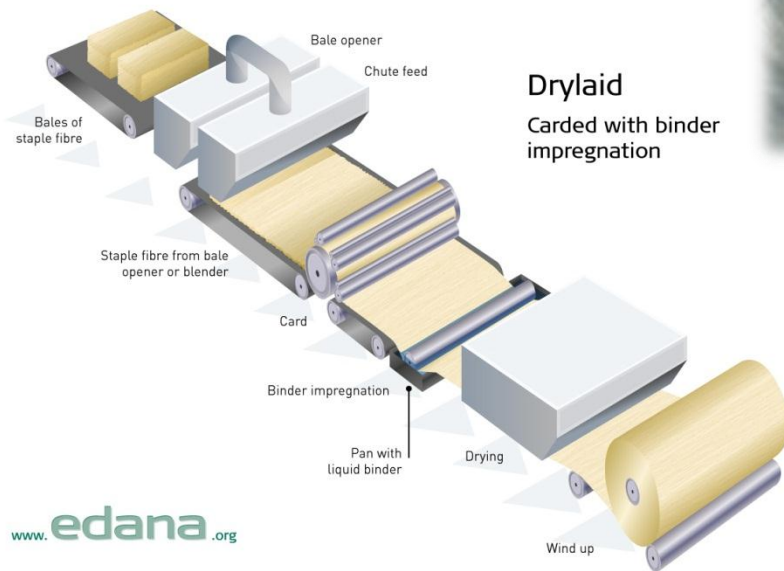
- Antistatisch
- Leicht zu schließen
- Stabile Laufeigenschaften
- Elektrostatisch gefährdete Positionen
- Karton / Verpackung / Zellstoff Trockensieb

Württembergische Spiralsieb- & Siebtechnik GmbH
70372 Stuttgart · Telefon
07141 300-1000
Telefax 07141 300-1001
E-Mail: info@spiralsieb.de
Internet: www.spiralsieb.de

Antistatic Spiral Fabrics

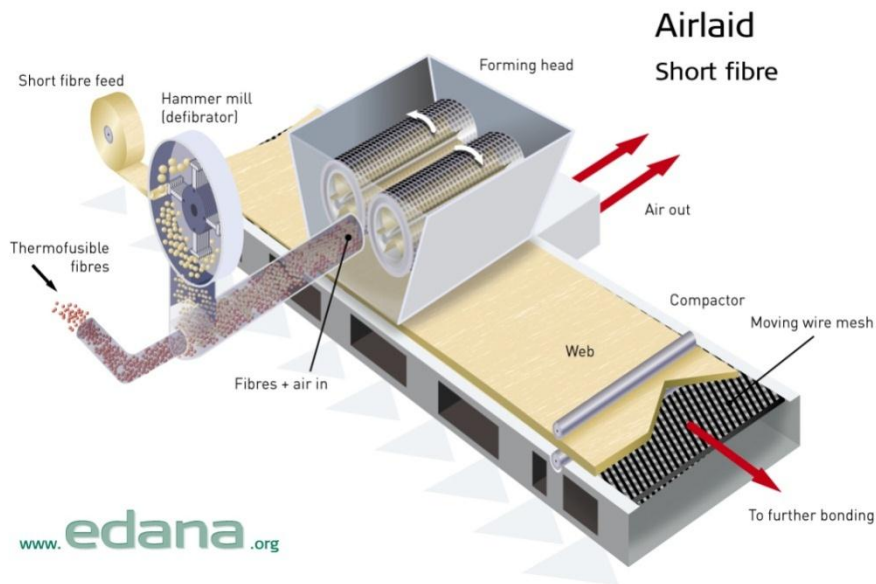
Possible applications in the nonwovens industry?

Drylaid



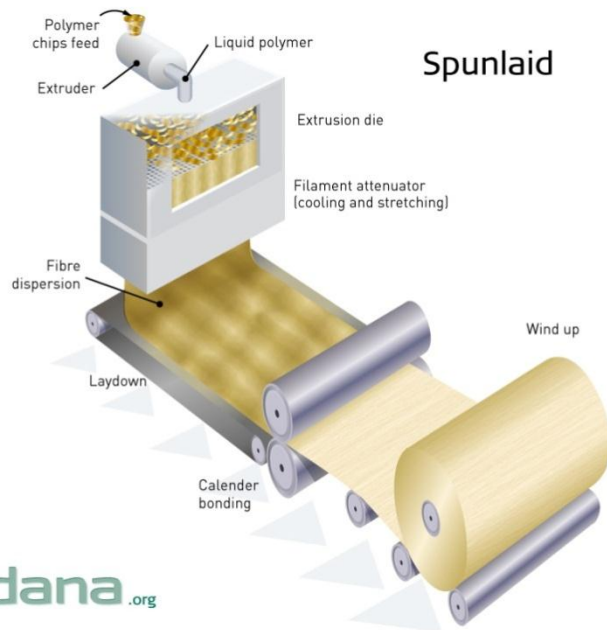
Antistatic Spiral Fabrics

Airlaid



Antistatic Spiral Fabrics

Spunlaid



www.edana.org



Antistatic Spiral Fabrics

Meltblown



Antistatic Spiral Fabrics

Wood industry

Wood industry / processing in
potential flash fire environments



Antistatic Spiral Fabrics

Reference sources:

- <http://image.made-in-china.com/43f34j00nZtTFRaWqpoE/SMMS-Four-Beams-Nonwoven-Fabric-Production-Line.jpg>
- <http://www.primechoicepkg.com/nonwoven.asp>
- http://upload.wikimedia.org/wikipedia/commons/7/71/OSB_production.jpg
- <http://www2.basf.de/basf2/html/kaurit/die-neue-leichtigkeit-im-moebelbau.htm>
- <http://www.tornado-tex.de/gebrauchte-textilmaschinen/vliesstoffanlagen-gebraucht.htm>
- http://www.edana.org/images/default-source/default-album/fig1_drylaid_carded_2603.jpg?sfvrsn=0
- http://www.edana.org/images/default-source/default-album/fig4_airlaid_2603.jpg?sfvrsn=0
- http://www.edana.org/images/default-source/default-album/fig2_spunlaid_b_2603.jpg?sfvrsn=0
- <http://www.tikp.co.uk/knowledge/technology/nonwovens/under-construction/>
- <http://www.spunbond.ru/upload/medialibrary/271/271f2b403ddf5735c9b7f482dc28745f.jpg>
- <http://www.irema.com/pop-ups/meltblown-manufacturing-process/>
- <http://www.stfi.de/en/stfi/research/center-of-excellence-in-nonwovens/bilder/meltblown-plant.html>
- http://mpm.com/nonwoven/news/non-woven_media_news/pilot
- <http://www.hightechfinland.com/direct.aspx?area=htf&prm1=973&prm2=article>



Antistatic Spiral Fabrics

The WSF-Homepage is work in progress, but we'll gladly visit you personally to introduce our company / product portfolio / capabilities and to discuss your client requirements.

Jürgen Jordan - Business Development

Tel. +49 (0)7163 53605-13

Mob. +49 (0)160 4727425

juergen.jordan@wuertt-sf.de

Oliver Maier - Product Development

Tel. +49 (0)7163 53605-11

oliver.maier@wuertt-sf.de



Antistatic Spiral Fabrics

Thank you for your interest!

Oliver Maier, January 2017

