

# Permanent antistatic and conductive compounds for monofilaments and tapes



# A few words about CABOT

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- Founded in 1882 by Godfrey L. Cabot in Pennsylvania who started Carbon black business for the tire industry
- Today leading supplier of carbon black, of masterbatches and conductive Compounds
- 4200 employees in 23 countries and 45 sites
- 5 plants for masterbatches and conductive compounds in Asia and Europe

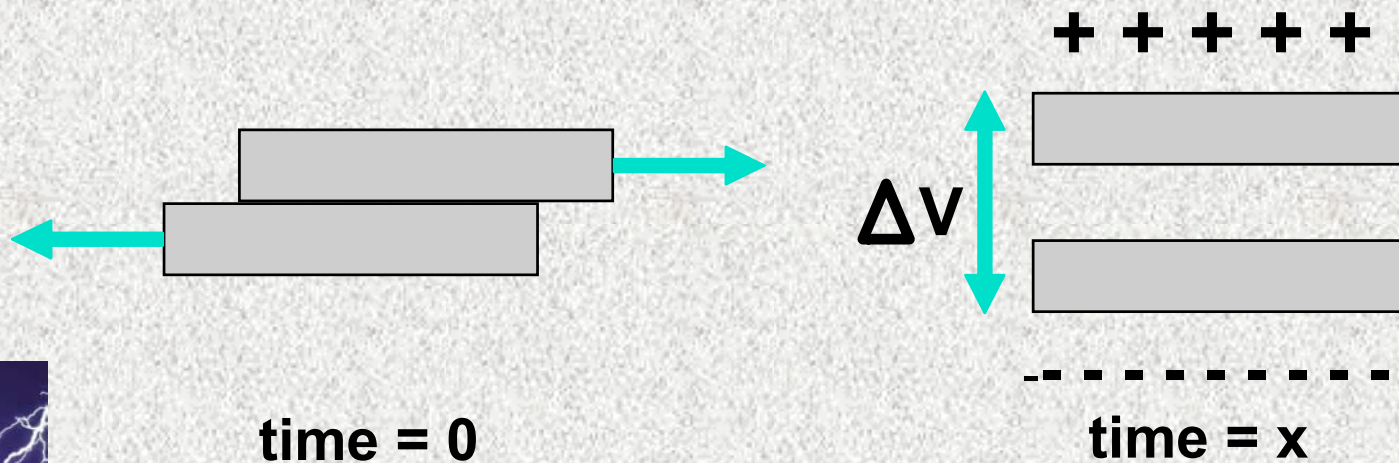


# What is static electricity ?

## Definition of static electricity or electrostatic charges

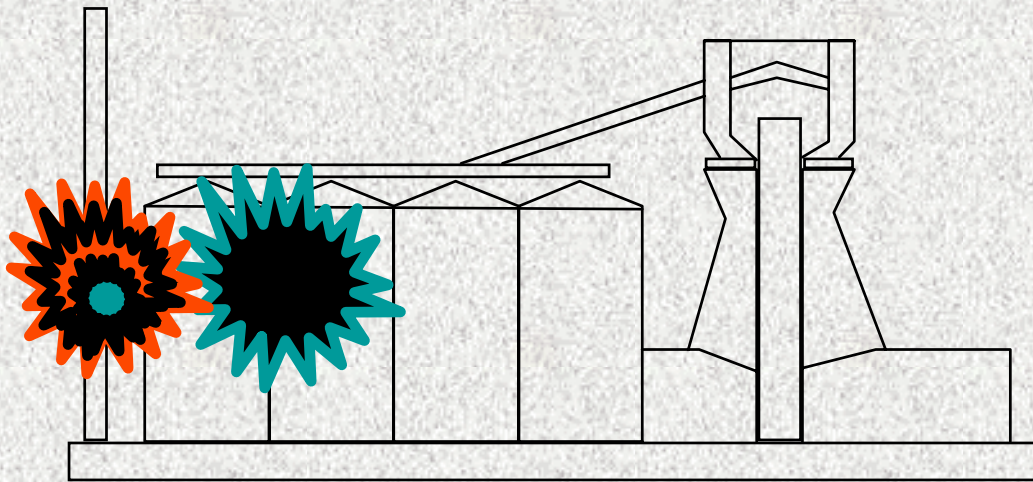
Stationary electrical charge generated when two materials enter into contact and then separate.

This leads to an imbalance of electrons causing an electrical tension on each surface (= Voltage ).



# Why to avoid static electricity?

*ESD electrostatic discharge can cause Self-ignition of powders or liquids resulting in explosion or fires or deteriorate electronic components:*

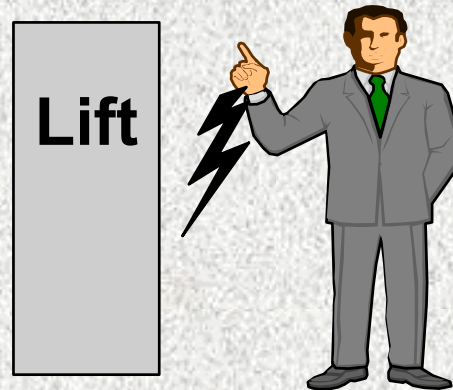


**E.g. Dust explosion in grain-silo, mining,...**



# Why to avoid static electricity (contd)

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*ESD - electrostatic discharge causes nuisance to human comfort for instance when touching an elevator switch after walking on a carpet or when leaving a car*



# Why to avoid static electricity (contd)

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**Static electricity favours dust attraction/retention.  
Can be detrimental for:**

- Hygiene conditions
- Optical aspect
- Functionality (filter cleaning, contaminations,...)



# How to avoid ESD ?

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**Avoid build up of static loading / allow transfer of electrical charges .**

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# Solution: Antistatic materials

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Resistivity (Ohm.cm)

10E14  
10E12  
10E10  
10E8  
10E6  
10E4  
10E2  
1  
10E-2  
10E-4

ANTISTATIC

## Definition

Materials exhibiting properties which minimize electric charge generation when rubbed against or separated from the same or other material



# Current Antistatic Materials

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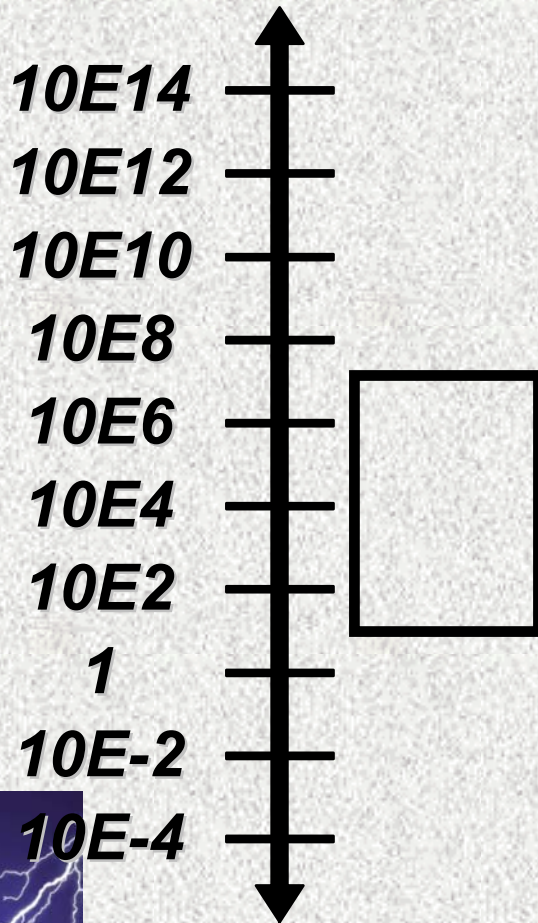
- ⇒ **Non permanent additives**  
migration at the surface of additive with polar, hydrophilic component. Absorbed humidity forms conductive path
- ⇒ **Permanent additives and materials**
  - ➔ **Carbon black based compounds**
  - ➔ **Metal fibers & coatings**
  - ➔ **Other conductive materials: ICP/IDP**

**Cabot offers several solutions for permanent antistatic materials (compound or masterbatch)**



# CABELEC®: carbon black based conductive compounds

Resistivity ( Ohm.cm )



- ▶ Permanent, non humidity dependent conductive material
- ▶ low resistivity levels
- ▶ rapid charge decay
- ▶ cost effective
- ▶ UV stable solution

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# Conductivity

## Material

## Volume Resistivity

ohm.cm

Polyethylene

$1 \times 10^{16}$

Carbon Black

$4 \times 10^{-3}$

Graphite

$8 \times 10^{-4}$

Steel

$1.6 \times 10^{-5}$

Copper

$1.7 \times 10^{-6}$

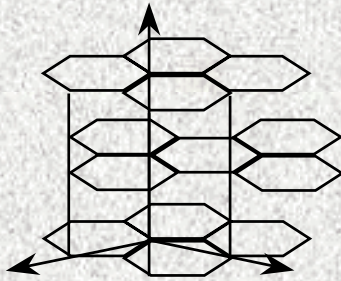
**When CB is compounded in plastics,  
conductivity is imparted by the CB**



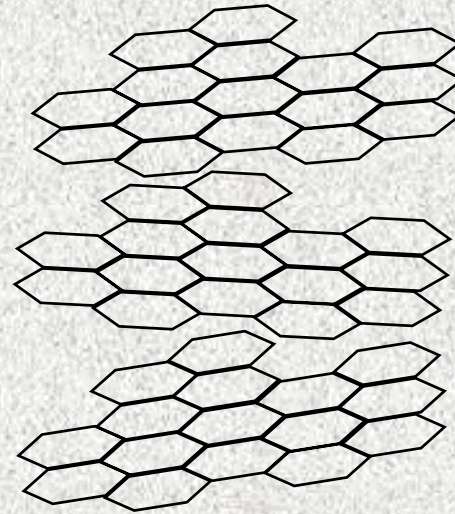
# Carbon black

## Atomic Structural Models

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**GRAPHITE**



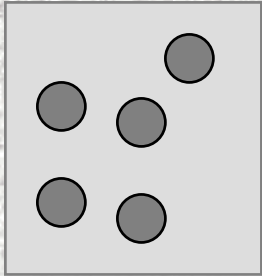
**CARBON BLACK**

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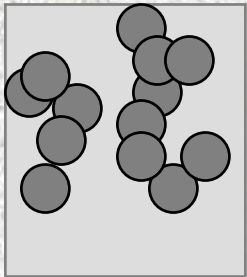
# Carbon Black terminology

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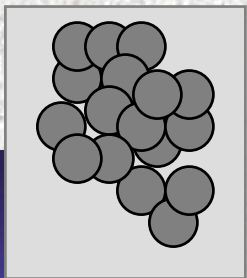
Particle = Primary “spherical” unit

Typical size: 30-70 nanometers



Aggregate = Covalently bonded particles

Typical size: 200-500 nanometer



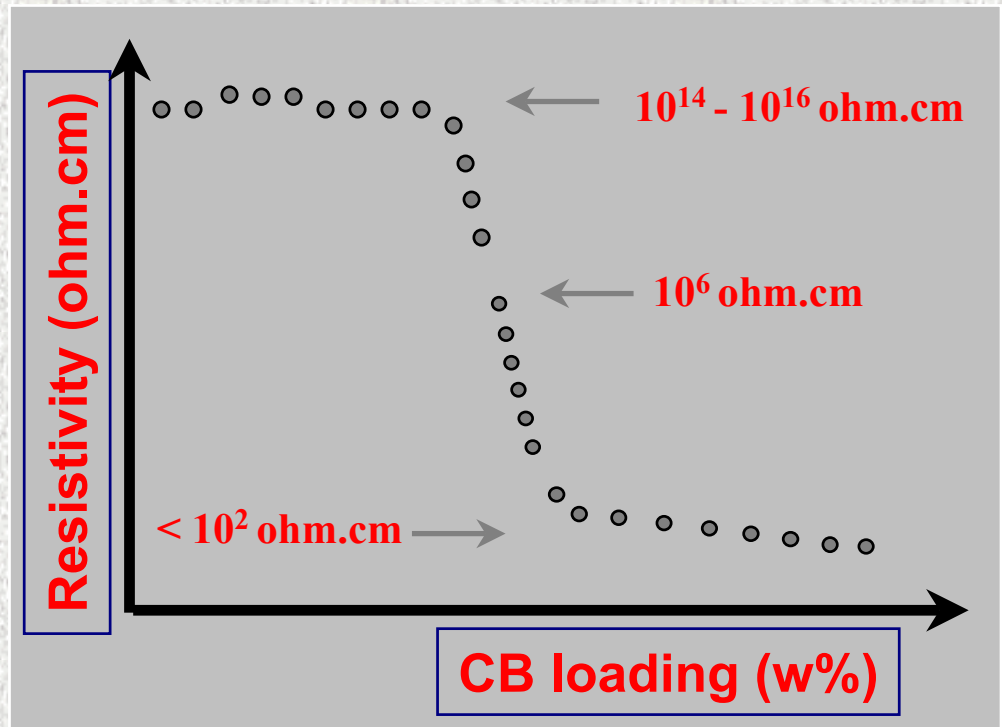
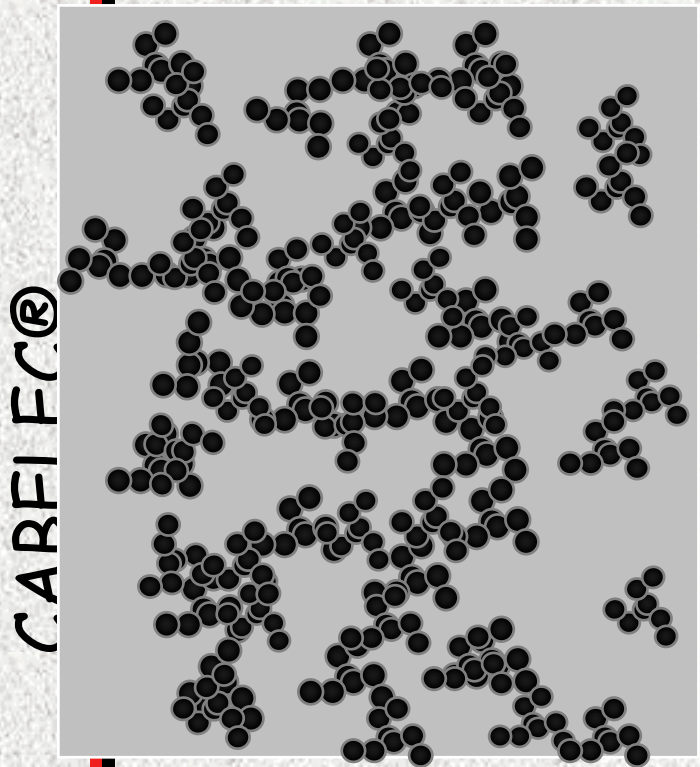
Agglomerate = Group of aggregates held together by Van der Waals forces.

Typical size: up to 1000 micron

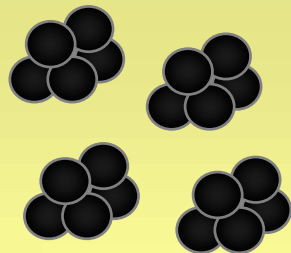
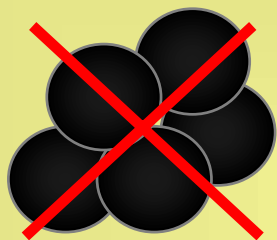
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# CB induced conductivity in plastics

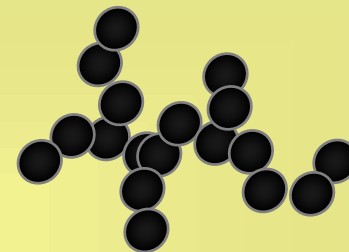
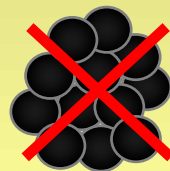
- Conductivity depends on CB loading
- Relationship is not linear



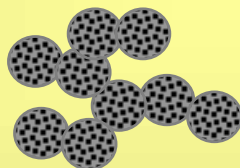
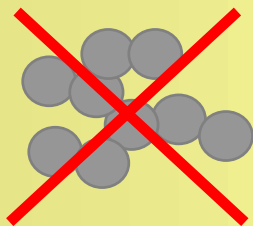
# Characteristics of conductive CB



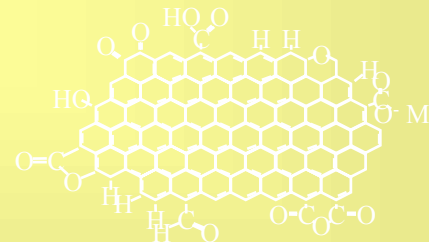
**Small primary particles  
= High surface area**



**High structure  
= High DBPA**



**High porosity**

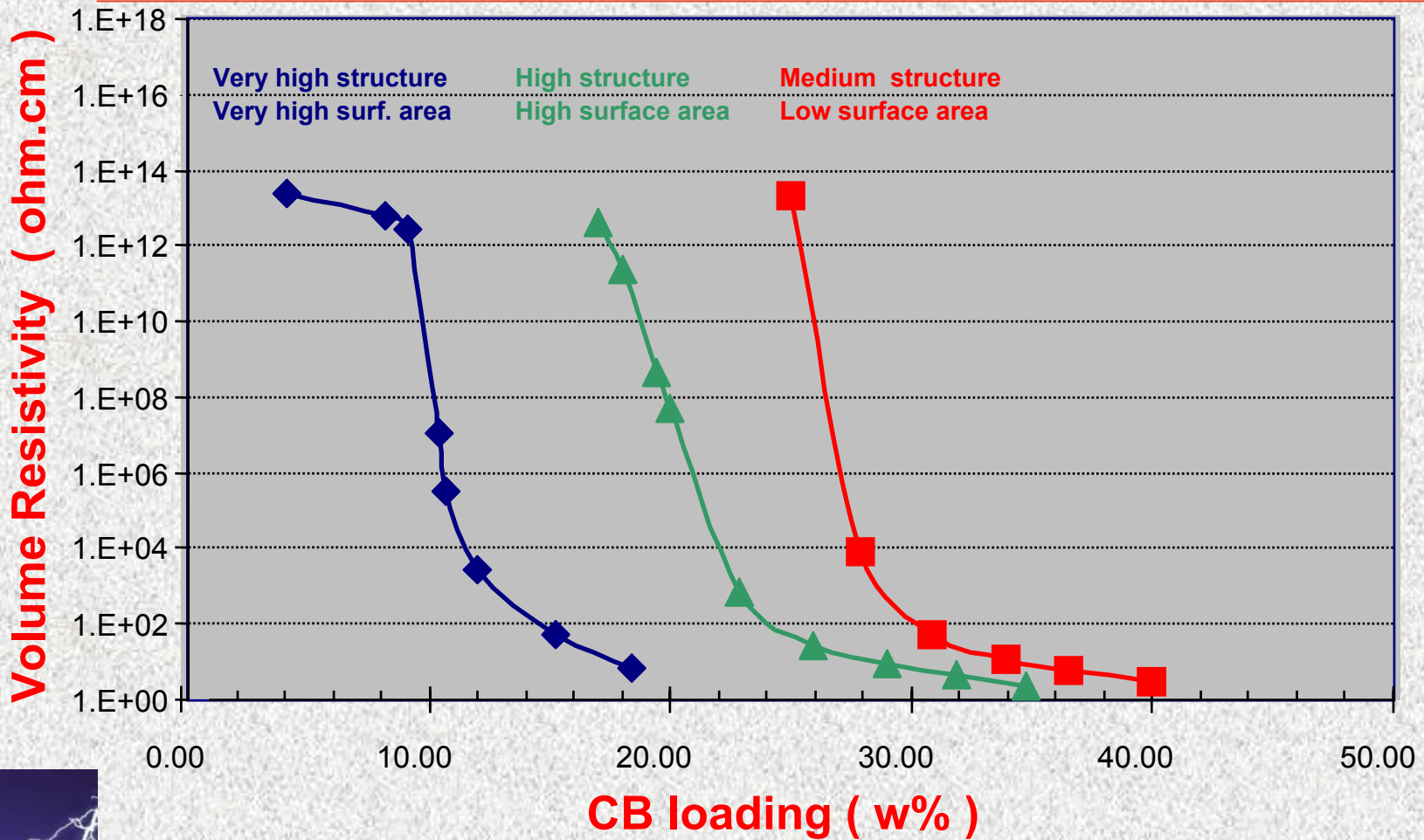


**Low surface oxidation  
= Low volatile content**

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# Percolation curves: examples



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# Main Application Segments - CABELEC®

- **Automotive Industry**



- **Industrial (safety)**



- **Electronics**



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# Application segment - tapes

E.g. for earthable big bags for handling dangerous goods.

Polymer base: PE CA 3841

Polymer base: PP CA4701



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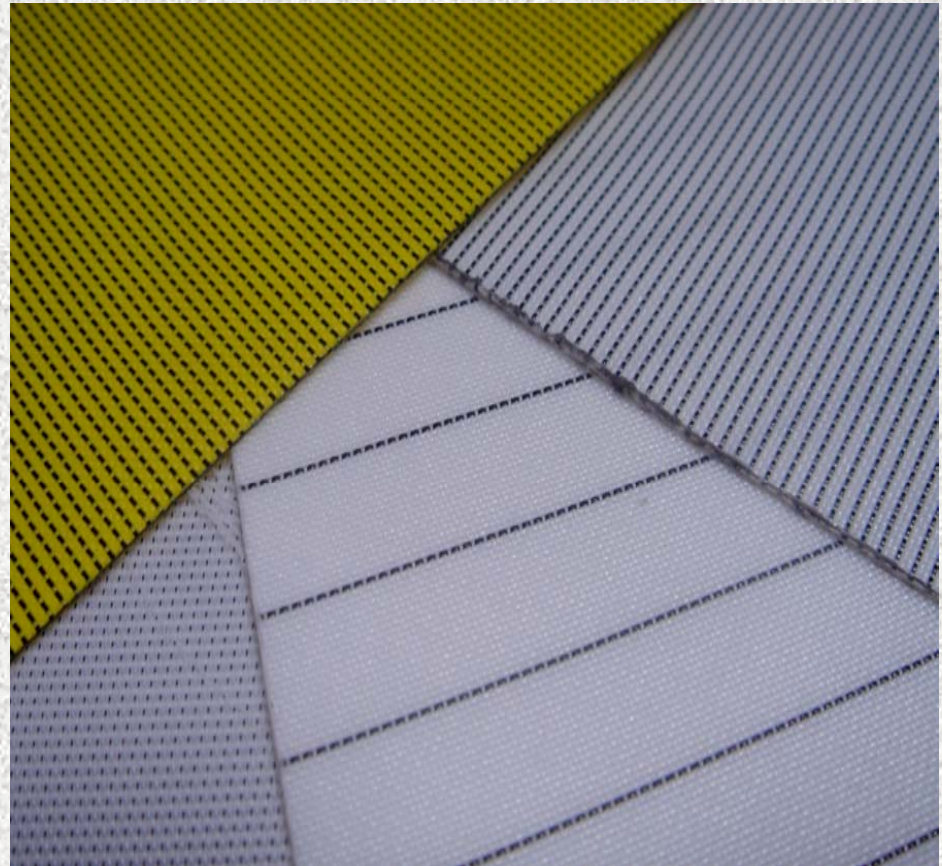


# Application Segment - monofilaments

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## Fabrics for

- ⇒ ESD
- ⇒ Transport
- ⇒ Safety clothing/textiles



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# Application Segment - monofilaments

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## Filters for

- ⇒ liquid/solid separation
- ⇒ sieve fabrics for chemical & pharmaceutical industry
- ⇒ air filters



# New opportunities

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- Increased demand in safety segments due to implementation of ATEX directives
- Applications exploiting conductive compounds as electrical resistors, sensors,...

For the above opportunities we can offer our expertise in compounding , testing and formulation development



*Thank you very much for  
your attention !*

