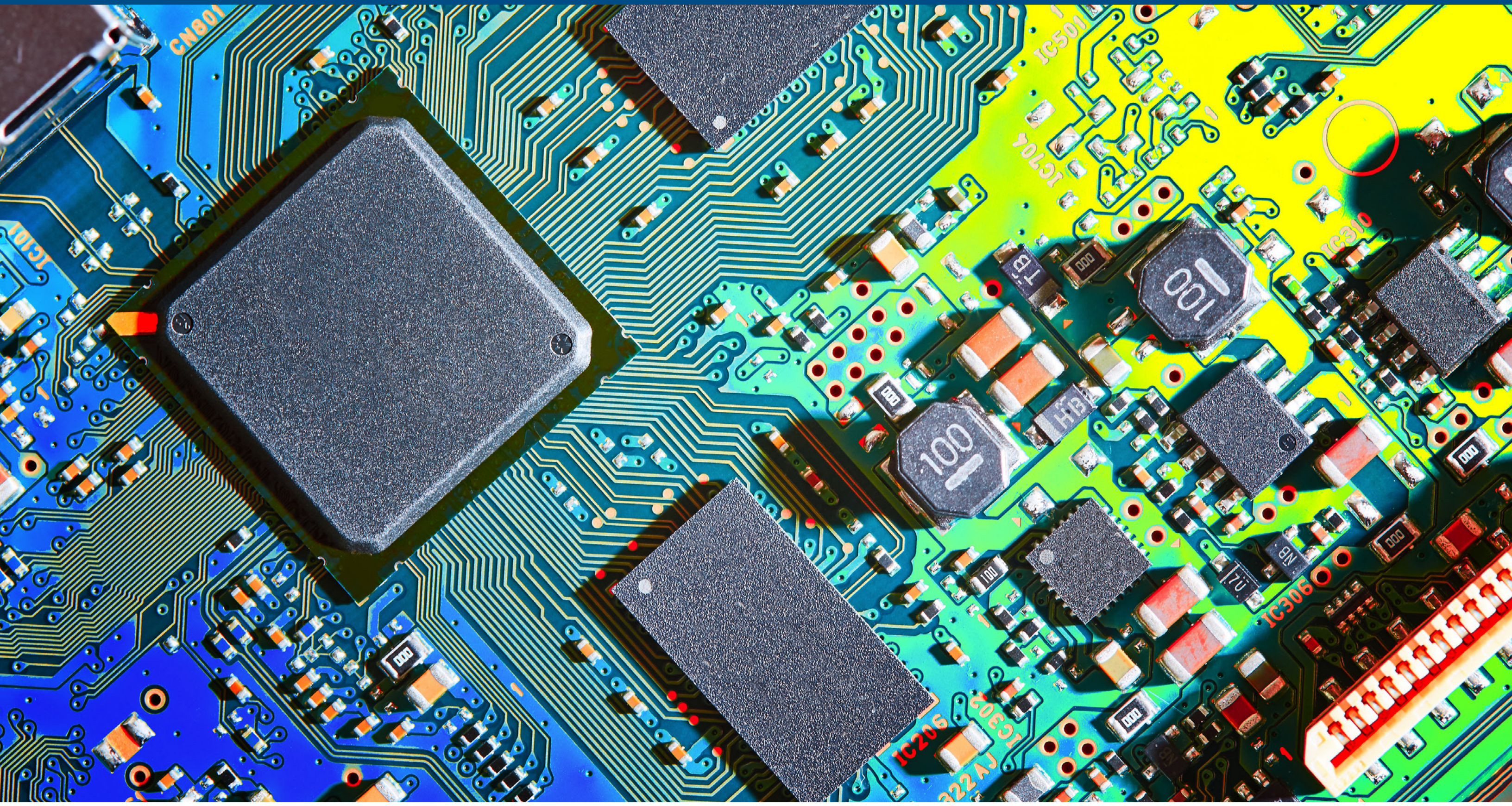
Milliken®

Zelec®

Electroconductive Powders



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Zelec® ECPs provide cost-effective, static-dissipative performance in both coatings and plastics. Other conductive agents such as carbon black, metals, or ionic surfactants cannot match all of Zelec ECPs benefits.

Why choose Zelec ECPs?

Flexibility
Light in color allowing a broad spectrum of colors

Adaptability
Can be formulated in solvent or water-borne coatings forming dry, transparent static dissipative films

Versatility
Can perform over a wide range of surface resistivity 10^3 to 10^{12} ohms/sq

Stability
Humidity independent performance, non-volatile, non-corrosive, heat and chemical resistant

Durability
Resistivity imparted for the life-time of the product

What are Zelec® ECPs?

Zelec ECPs are inorganic, conductive powders that have been developed for applications where the dissipation of static charge in transparent, translucent, and opaque coatings and plastics is important.

Milliken offers many different types of Zelec ECPs that can be used according to your needs and requirements. Each powder is unique due to its core structure and particle size.

Core-Shell Structure

The core-shell structure is a highly efficient, cost-effective way of utilizing antimony-doped tin oxide. This structure consists of a dense layer of crystallites of antimony-doped tin oxide on an inert core particle. The silica adhesion coat reduces the likelihood of conductive coating being removed through hi-shear dispersion processing. The antimony is in a solid solution with the tin oxide and is used as a conductive outer shell.

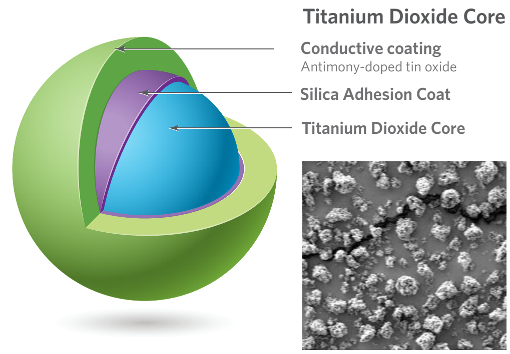
Titanium Dioxide Core (-T Types) This particular powder is extremely robust under high-shear dispersion techniques and can provide opacity into coatings and plastics.

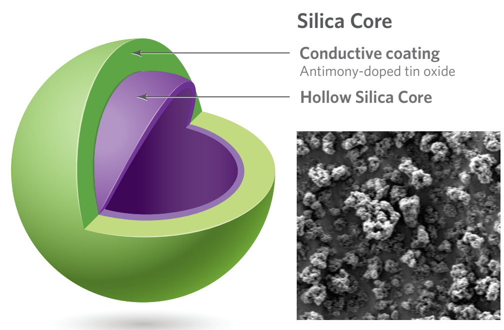
Silica Core (-S Types) This unique, hollow core provides excellent efficiency through its elliptical shape and low density.

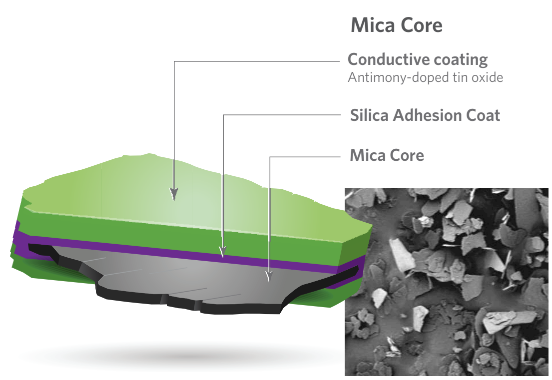
Mica Core (-M Types) The plate-like shape of the mica core is beneficial in the formation of particle-to-particle networks in films and plastics.

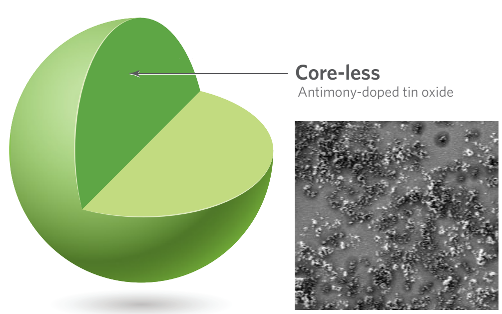
Core-Less Structure

There is one powder (-XC Type) that does not contain a core particle; it consists of antimony-doped tin oxide only. This product has excellent conductive properties and can be used in formulations where both transparency and conductivity of the dry film are requirements.







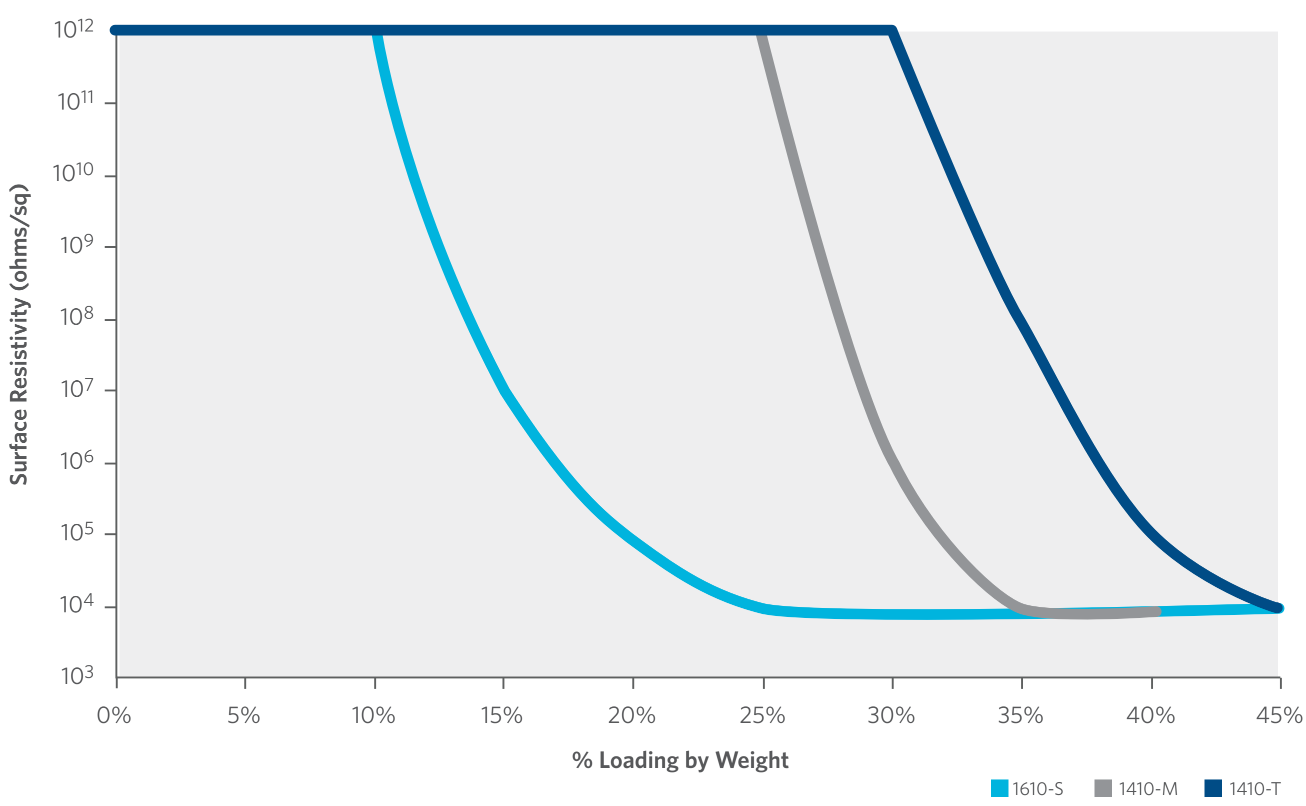


Product Offering

Grade	Core Shell	Particle Size (micron)	Key Properties	Major Applications
1410-T	Titanium	1	Opaque applications. Robust core for severe mixing operations. Higher loadings required due to insulation core shell.	Powder coating
3410-T	Titanium	0.5	As above, but smaller particle size for smoother coatings with higher gloss. Provides good base color	Printing - Coated paper/ film
1410-M	Mica	5	Translucent applications especially at low coating thickness. Low gloss.	Plastic compounding, paints
1610-S	Hollow Silica	3	Translucent applications. Most efficient loading efficiency and lowest density. Best general purpose grade.	Flooring - Epoxy/ PU
3010-XC	None	0.5	Transparent thin film coatings. Dispersed on high-shear agitated media mills.	Glass coating/ varnishes

Loading Efficiency Example in Epoxy Resin

ZELEC® ECP's – Percolation Curve



This example illustrates the ability to control the desired surface resistivity in epoxy resin by Zelec® ECP selection and loading.

Industry Acceptance

SURFACE RESISTIVITY

The ESD Association Glossary, ESD-ADV 1.0-1994 (1), describes Surface Resistivity in the following way: For an electric current flowing across a surface, the ratio of DC voltage drop per unit length to the surface current per width. In effect, the surface resistivity is the resistance between two opposite sides of a square and is independent of the size of the square or its dimensional units. Surface resistivity is expressed in ohms per square. *(from EOS/ESD-S11.11 - 1993)*

Anti-static compounds (10^{10} to 10^{12} Ohms/sq surface resistivity)

Provide a relatively slow decay of static charge - from just hundredths to several seconds – thus preventing accumulations that may discharge or initiate other nearby electrical events.

Static dissipative compounds (10^{6} to 10^{10} Ohms/sq surface resistivity)

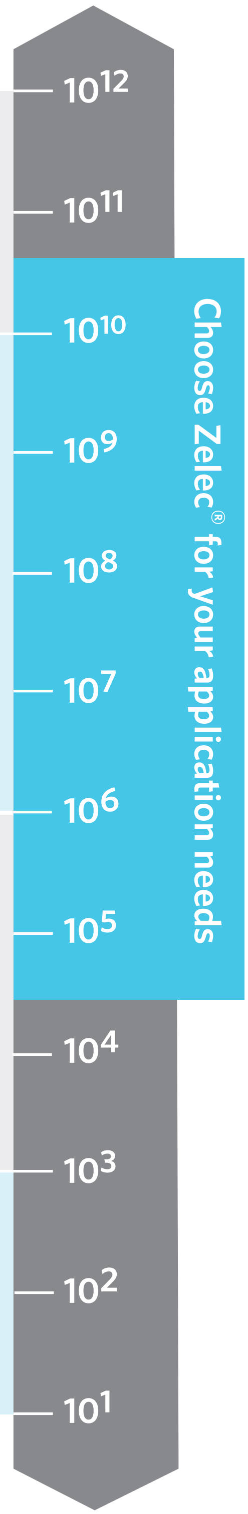
Allow for dissipation or decay of static charges at a faster rate than anti-static materials – generally within milliseconds.

Conductive compounds (10^{3} to 10^{6} Ohms/sq surface resistivity)

With decay/dissipation rates measured in nanoseconds provide a ground pathway and bleed off strong static charges.

EMI/ RFI shielding compounds (10^{1} to 10^{3} Ohms/sq surface resistivity)

Compounds are typically qualified by means other than electrical conductivity, as their true function is in blocking electromagnetic and radio frequency energy. These shielding compounds absorb and/or reflect electromagnetic energy, providing shielding against electromagnetic interference.



How Can I Use Zelec® ECPs?

Coatings

The most efficient way to impart surface conductivity is to apply a thin Zelec ECP based coating on the surface. Zelec ECPs can be dispersed into coatings using techniques similar to pigments, such as titanium dioxide. These techniques include high-speed mixers and media milling. Zelec ECPs are compatible with a wide range of resins including acrylics, epoxies, urethanes, and polyesters.

Zelec ECPs can be used in coatings to provide translucent to transparent, static-dissipative films. The degree of transparency is dependent on a number of factors including the grade of Zelec ECPs, resin type, dispersants, dry film thickness and the technique used to incorporate the ECP into the dispersion.

Plastics

There are two ways that Zelec ECPs can be used with plastics. First, if conductivity at the surface of the plastic is required, the powder can be applied to the surface as a component of a coating or a co-extruded film. This is a very efficient method of utilizing the powders, because the conductive particles are concentrated in a thin layer at the surface.

Second, if conductivity throughout the matrix of the plastic is required, Zelec ECPs can be dispersed into the bulk polymer through extrusion.

Areas where Zelec provides solutions

Continuous film applications

Electronic processing, handling & repairing

Packaging of dusty organic materials

Automotive: Electrostatic discharge of fuel lines leading to fires

Inflammable and explosive environments

Healthcare - operating theatre

Painting shops

Clean room contamination

Markets & applications

Flooring - Epoxy & PU self leveling floors

Markets: Electronic, automotive, aviation, military, ammunition & explosives, mission control & data storage centers, clean room and healthcare

Metal Powder Coating - ceiling grids, desks & chairs, data storage cabinets, work stations etc.

Paints, Primers, Inks and Adhesives - anti-fog/ heated mirrors, transparent glass coating,, sealants, plastic paint primers, anti-radiation

Electronic Industry - transportation boxes, ESD trays, wafer carriers, disk-drive components, printed circuitry, packaging & films, antistatic ID labels, LCD's, solar panels & batteries

Other - textiles, medical equipment, laminates, color toners, explosive handling devices, bulk containers, powder handling systems

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REGIONAL HEADQUARTER OFFICES

NORTH AMERICA

Spartanburg, SC, USA
P. 1.800.910.5592
F. 864.503.2430
millichem@milliken.com

EUROPE

Gent, Belgium
P. 32.9.265.1100
F. 32.9.265.1195
eurochem@milliken.com

LATIN AMERICA

Sao Paulo, Brazil
P. 55.11.3043.7942
F. 55.11.3043.7096
lachem@milliken.com

Mexico City, Mexico
P. 52.55.3088.3600
F. 52.55.9000.2643
lachem@milliken.com

ASIA

Singapore
P. 65.6377.0770
F. 65.6377.0990
asiachem@milliken.com

Shanghai, China
P. 86.21.6145.5555
F. 86.21.6145.5558
asiachem@milliken.com

Pune, India
P. 91.20.6730.7501
F. 91.20.6730.7514
asiachem@milliken.com