

Electro Conductive Thermoplastics for Static Control and EMI Shielding

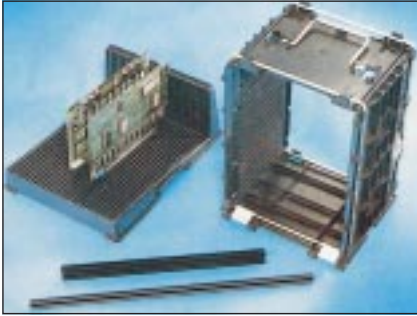


TBA Electro Conductive Products



www.tbaecp.co.uk

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Introduction to Conductive Thermoplastics

TBA Electro Conductive Products supplies a wide range of polymers modified with a variety of conductive fillers. These plastics are tailored to provide varying degrees of electroconductivity and are especially suitable for use in applications where protection from static electricity and electromagnetic interference is required.

Conventional plastics are normally electrically insulating materials which typically exhibit surface resistivities of 10^{14} - 10^{16} ohms per square.

The TBA Electro Conductive Products range of conductive plastics fills the gap between the normally insulating plastics and metals, and can be broadly categorised as:

Static dissipative plastics and EMI shielding plastics.



Static dissipative Plastics

Surface resistivities between 10^6 and 10^{12} ohms per square, for use in applications where slow and controlled dissipation of electrostatic charges is required.

Conductive Plastics

Surface resistivities of less than 10^6 ohms per square, designed to meet the requirements of BS EN 100015 part 1 (specifications which refer to the protection of electronic components from electrostatic damage).



EMI Shielding Plastics

Volume resistivities less than 1 ohm-cm and up to 55 dB attenuation of EMI radiation.

ECP 100 Range Static Control Plastics

A wide range of polymer bases are employed to produce conductive plastics, including the polyolefines, nylons and ABS. Typical applications are illustrated using ECP 104 mineral filled conductive polypropylene which can be used to mould a variety of containers for static sensitive devices and PCB handling equipment. The mineral filler produces rigid mouldings with excellent dimensional stability.

- Permanently conductive
- Easily processed on conventional moulding equipment
- Grades tailored to suit a variety of requirements.



ECP 2000 Static Dissipative Plastics

The new ECP 2000 series of static dissipative polymers have been formulated specifically for clean room environments where low offgassing, low particulate, contamination and washability are required. The compounds can be coloured.

The materials are permanently conductive and can be processed on conventional equipment. The products are humidity independent, aqueous washable and can be re-used.

Applications that are ideally suited for the compounds and in use commercially at customer sites include: packaging for electronic components, medical device packaging, in-process carriers, fixturing devices, chip rails, vacuum tubing and business machine components.

Because of their flexibility, the thermoplastic polyurethane (TPU) based alloys are also useful as softwall cleanroom materials, flexible packaging, hose and tubing, floor and table mats and other flexible cleanroom applications.



Electro Conductive Thermoplastics for Static Control and EMI Shielding

PRODUCT DESCRIPTION					
Grade Ref.	Polymer	Processing	Surface Resistivity Ω/sq	Features	
CONDUCTIVE PLASTICS	ECP 104	Polypropylene	Injection Moulding	10^3	General purpose mineral reinforced
	ECP 110	Polypropylene	Various	10^3	General purpose high impact
	ECP 115	Polypropylene	Coating and Injection Moulding	10^4	Wire coating
	ECP 121/1014	Polyethylene Vinyl Acetate	Various	10^3	General purpose flexible
	ECP 121/1015	Polyethylene Vinyl Acetate	Various	50	Flexible moulding low level shielding
	ECP 122	Low Density Polyethylene	Various	10^3	Flexible/Blow/Injection moulding
	ECP 123	High Density Polyethylene	Various	10^4	Blow moulding/High impact/Injection – moulding
	ECP 125	Low Density Polyethylene	Film Grade	10^4	Film grade and flexible injection moulding
	ECP 145	Nylon 6	Injection Moulding	10^3	Modified Nylon 6
	ECP 172	Polystyrene	Injection Moulding	10^4	Injection moulding
STATIC DISSIPATIVE PLASTICS	ECP 2200	Polypropylene	Injection Moulding and Thermoformable Sheet	10^{11}	Opaque, Colourable static dissipative pellet for injection moulding
	ECP 2693	PETG	Injection Moulding and Thermoformable Sheet	10^{10}	Opaque, Colourable static dissipative pellet injection moulding and Thermoformable sheet
	ECP 2809	Acrylic	Injection Moulding and Thermoformable Sheet	10^{10}	Translucent, Colourable static dissipative pellet injection moulding and Thermoformable sheet
	ECP 2310	ABS	Injection Moulding and Thermoformable Sheet	10^{10}	Translucent, Colourable dissipative pellet for injection moulding
	ECP 21140	Polyester TPU	Flexible Sheet	10^{11}	Translucent Flexible sheet for softwall/Flexible Packaging
	ECP 21150	Polyether TPU	Flexible Sheet	10^{11}	Translucent Flexible sheet for softwall/Flexible Packaging

Electro Conductive Thermoplastics for Static Control and EMI Shielding

PHYSICAL AND ELECTRICAL PROPERTIES											
Specific Gravity g/cm ³	Tensile Strength (Mpa)	Tensile Modulus (Gpa)	Flexural Strength (Mpa)	Flexural Modulus (Gpa)	Impact Strength			Deflection Temp		Melt Flow Index (°C/Kg) g/10 min	
					IZOD J/m ²	CHARPY UN/N KJ/m ²	CHARPY N KJ/m ²	Under Load (°C at 0.45 Mpa)	Under Load (°C at 1.81 Mpa)		
1.10	21.0	2.4	38.0	2.2	41.0	25.0	7.0	102.0	85.0	10 (230/10)	5 (230/5)
1.03	24.0	1.6	34.0	1.3	D.N.B.	D.N.B.	D.N.B.	78.0	49.0	10 (230/10)	1 (230/5)
1.04	20.0	1.3	29.0	1.2	170.0	D.N.B.	5.0	69.0	46.0	10 (230/10)	1 (230/5)
1.10	10.0	0.5	12.2	0.4	590.0	D.N.B.	D.N.B.	N/A (Melt Temp 103 °C)		3 (190/21.6)	0.3 (190/10)
1.10	10.0	.05	12.2	0.4	590.0	D.N.B.	D.N.B.	N/A (Melt Temp 103 °C)		3 (190/21.6)	0.3 (190/10)
1.06	15.0	0.8	19.0	0.6	D.N.B.	D.N.B.	D.N.B.	N/A (Melt Temp 80 °C)		10 (230/10)	2 (230/5)
1.07	15.5	1.1	22.0	0.8	D.N.B.	D.N.B.	D.N.B.	N/A (Melt Temp 120 °C)		6 (190/21.6)	0.7 (190/10)
1.00	12.0	0.6	N/A	N/A	N/A	N/A	N/A	160.0	N/A	5 (190/10)	1 (190/5)
1.22	55.0	2.98	83.5	2.64	103.9	D.N.B.	7.0	140.0	210.0	43 (275/10)	9 (275/5)
1.07	15.4	1.56	30.6	1.41	12.0	9.4	4.1	81.0	51.0	6 (200/10)	0.8 (200/5)
0.93	28.0	1.61	Not available	1.4		Not available	Not available	Not available	Not available	5 (230/2.16)	Not available
1.25	31.0	1.24	Not available	Not available	1070	Not available	Not available	Not available	Not available	5 (230/2.16)	Not available
1.11	27.0	1.51	Not available	Not available	140.0	Not available	Not available	Not available	Not available	2 (230/2.16)	Not available
1.08	23.0	1.3	Not available		180.0	Not available	Not available	Not available	Not available	10 (230/2.16)	Not available
N/A	32.0		Not available		Tear Strength 68 N/m	N/A	N/A	N/A	N/A	N/A	N/A
N/A	30.0		Not available		Tear Strength 65 N/m	N/A	N/A	N/A	N/A	N/A	N/A

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TYPE	BINDER	USES
ECP 12E	Emulsion-based ethylene acrylic acid zinc ionomer binder, 25% by weight	Styrenic Thermoplastics, PS, SAN, ABS also PPO and PPE Alloys. Polypropylene/ Polyolefines
ECP 16E	Nylon 6/12, 25% by weight	Nylon 6, 6/6, 6/10, 6/12, PBT, PET
ECP 20E	Polycarbonate, 40% by weight	Polycarbonate, Polysulphone, PES, PET, PEJ, PBT

EMI Shielding Thermoplastic Stainless Steel Fibre Masterbatch

The masterbatch is added at very low levels ensuring minimal effect on colour, mouldability and other base polymer properties 1% by volume.

The use of this system allows shielded articles to be produced in one process without additional equipment, labour or secondary processing and provides cost effective solution to EMI shielded problems.

Features

- No secondary process
- Used in any plastic moulding application
- Can be coloured
- Provides shielding of 50dB attenuation

Benefits

- Cost effective
- Non-abrasive
- Minimal effect on colour
- Eliminates secondary shielding process

Material Specification

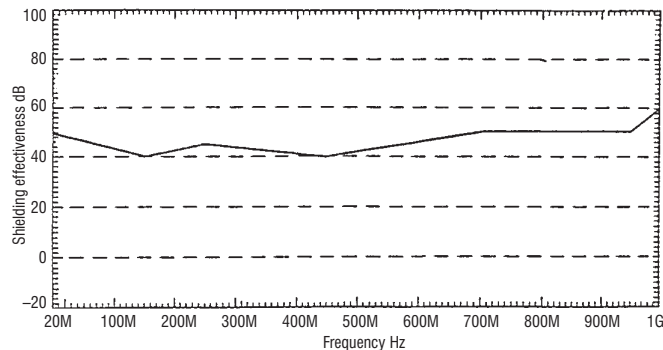
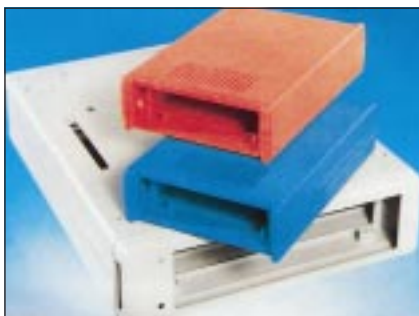
- A masterbatch pellet
- Stainless steel fibre AISI304, bonded with polymer specific binder
- In pellet form, 5mm chopped length

Shielding Data

Shielding effectiveness measured using shielded room test MIL STD 285 – 3mm thick plaque. 1% volume steel fibre.

Typical Physical Properties in ABS

Tensile Strength (MPa)	32.30	Impact Strength	
Tensile Modulus (GPa)	2.36	Charpy Un-N (kJ/m ²)	15.90
Flexural Strength (MPa)	58.00	Charpy N (kJ/m ²)	7.10
Flexural Modulus (GPa)	2.19	Izod (J/m)	55.10
Elongation (%)	3.50	Specific Gravity (g/cm ³)	1.35
		Deflection Temp:	
		Under Load (°C)	65.0 at 1.81 Mpa
			78.0 at 0.45 MPa



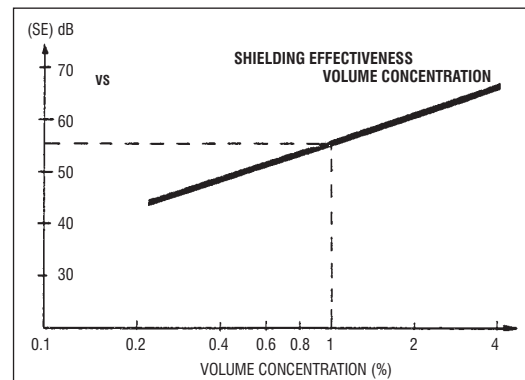
Mouldability of Steel Fibre Filled Conductive Plastics

Steel fibre added to a plastic compound will create an electrically conductive composite at extremely low concentrations. Typical use levels range from 0.5 to 1.5 volume % (approx. 3 to 10 weight %) compared to 5 to 30 volume % needed of other conductive additives for similar electrical performance.

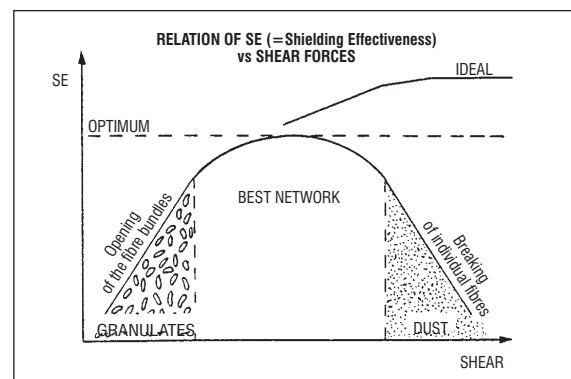
These electrically conductive composites are being utilised for electrostatic discharge (ESD) protection and electromagnetic interference (EMI) shielding. An electrically conductive thermoplastic compound may be injection-moulded with normal processing equipment, and parameters, into a cost-effective method of providing electrical protection. The typical loadings and their performance are listed opposite.

In general, it can be recommended that:

- The back pressure should be used as the main control of applied shear to the compound during the processing. Essentially, this means that enough back pressure is needed to create good dispersion of the fibres, but extreme levels of back pressure are to be avoided to maintain fibre integrity.
- Slightly higher processing temperatures could be used to enhance fibre dispersion.
- Injection screw RPM should not be extreme, or fibres may be worked into balls.
- Injection speed and holding pressure should be slower and lower than normal, so as to prevent migration of the fibres away from the gate area during the cooling cycle.
- Shot size should be normally between 35% to 60% of capacity.
- Gate size is not of extreme importance and it is recommended not to use very small gates. If dispersion is poor, fibre bundles could clog pin gates.
- Extremely long flow lengths are to be avoided, since the longer the flow, the more turbulence, or shear, is imparted to the compound causing a loss of fibre integrity.



VOLUME RESISTIVITY		
Vol %	(Ohm. cm)	Application
0.5	<103	ESD protection
1.0	1-10	EMI Shielding 30-50 dB
1.5	0.1-1	EMI Shielding 50-60 db
>	<0.1	EMI Shielding >60 db





Electro Conductive Products

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