

EMI/RFI Shielding by Application of Conductive Paints

Modern conductive paints can be applied to almost any engineering polymer to provide high levels of protection against Electromagnetic/Radio-Frequency Interference (EMI/RFI).

Achieving high levels of protection is only one criterion that needs to be considered when specifying a conductive coating for EMI/RFI shielding. At ACT we assess each project against the following criteria to determine the optimum coating solutions:

1. Level of Shielding Required	In general the shielding performance increases with increasing conductivity. Hence coatings with the highest conductivity or lowest resistivity offer the best level of shielding. Table (1) illustrates typical sheet resistance values (Ω -) as a function of applied thickness microns for some of the commonly used paints.				
Paint Ref	Description	Typical Sheet Resistance at Nominal			
		10 Φ	20 Φ	30 Φ	50 Φ
APPLICOAT ES110	Silver loaded paint	0.04	0.03	0.02	0.01
APPLICOAT ES210	Low solvent silver loaded paint	0.05	0.03	0.01	0.01
APPLICOAT EC225	Low solvent copper paint	0.2	0.1	0.05	0.03
APPLICOAT EN150	Nickel loaded paint	-	-	0.5	0.3
APPLICOAT EWS110	Water-based silver	0.06	0.04	0.02	0.01
2. Compatibility with Substrate Material	<p>The choice of coating is critical upon the substrate material, the following factors need to be considered:</p> <ul style="list-style-type: none"> • Effect of solvents. Most paints (eg. APPLICOAT ES110 and APPLICOAT EN150) are formulated with Methyl Ethyl Ketones (MEK) as the solvent. These systems are quick drying and provide excellent adhesion to most plastics. For solvent-sensitive substrates, such as Polycarbonate, a range of coatings is available formulated using very mild alcohol-based solvents (eg. APPLICOAT ES210 and APPLICOAT EC225). • Adhesion to substrate. Adhesion is normally tested using the cross-hatch tape test (ASTM D-3359-95a). All of the coatings provide excellent adhesion to most engineering plastics. However, to achieve best results, substrates should be clean and free from grease or mould release agents. • Curing temperature. To achieve optimum properties the coatings are cured at 60-70 deg C for a minimum of 20 minutes. For heat sensitive substrates, paints are available which can be cured at ambient temperatures. • Flexible substrates. APPLICOAT EFC240 is a paint containing silver-plated copper particles specifically designed for the application to flexible substrates. 				

3. Environmental Stability	All of the coatings offered by ACT have been extensively tested for long-term environmental stability. Tests devised by the Underwriters Laboratories are often used as the basis for determining the stability of the coatings (Ref: UL746C).	
	Test Requirements:	
	Temperature Ageing	85 deg C for 56 days
	Temperature Cycling	10 cycles of 75 deg C for 1 hour Room temperature for 1 hour -30 deg c for 1 hour
	Humidity	35 deg C for 56 days at 95% R.H.
APPLICOAT ES110, ES210, EC225 and EN150 exhibit no degradation in properties after the tests.		
4. Masking Characteristics	One of the key advantages of paint-spraying is the ability to coat mouldings selectively. Please consult our technical department for guidelines on defining making detail= for conductive paints.	
5. Recyclability	Peelable conductive paints have been developed to make re-cycling easier. However, most standard paints require mechanical/chemical removal to enable the polymer to be recycled.	
6. Wear Resistance	Most of the paints have a smooth, extremely hard durable surface. APPLICOAT E2210 for instance will pass 500+ cycles @ 1 mil dry with 55 gram weight. Conductive paints are not designed to function as external coatings; they can however be over-painted with aesthetic finishes.	
7. Quality Assurance	<p>Process control and extensive operator training ensure that all coatings are deposited to the required specification. Production parts are routinely tested for the following:</p> <ul style="list-style-type: none"> Resistivity - Aohms per square\approx and Apoint to point\approx tests are carried out to ensure the coating has been deposited to the required minimum thickness. Adhesion/Cohesion - a tape adhesion test is carried out to ensure the coating exhibits optimum bonding. Masking - all coated parts are 100% visually inspected to ensure masking detail is to drawing. Any over spray will be removed prior to despatch. 	

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