TA Instruments

Thermal Analysis & Rheology

THERMAL SOLUTIONS

MEASURING AND CONTROLLING RESIDUAL SOLVENT LEVELS IN WIRE COATINGS

PROBLEM

Discrete wired circuit boards utilize adhesive coated, insulated wire to form the signal wiring layer of the circuit. After the signal wiring has been encapsulated, manufacturing problems such as blistering and delamination can occur due to residual solvent in the adhesive coating. Hence, a reliable incoming quality control test to detect the presence of any residual solvent in the wire coating is required.

SOLUTION

Thermal analysis techniques measure changes in material properties with temperature and are ideal for characterizing electronic materials such as wire coatings. Two techniques in particular, TGA and TMA, can be used to detect residual solvent in coatings. Figure 1 shows the TGA results for a problem wire coating and a control wire. The problem wire loses 0.6 % weight loss below 250°C, while the control wire loses none. Since, the adhesive coating accounts for only 10% of the total sample weight, this weight loss indicates that a significant amount of solvent may be present in the wire coating. As seen in Figure 2, coupling TGA to FTIR confirms that the weight loss is due to residual solvent used to apply the adhesive to the insulated wire.

TMA provides a useful alternative method for detecting and quantifying the residual solvent in the wire coating by measuring the softening temperature of the wire coating using a flexual probe. Figure 3 shows that the softening temperature of the problem wire is ~ 40°C lower than the control wire, undoubtedly due to the plasticizing effect of residual solvent.

Using wire samples with known levels of residual solvent, a calibration curve based on the TMA softening temperatures, can be constructed (Figure 4) and used to provide a fast and accurate quality control method for detecting residual wire coating solvent, thereby eliminating further manufacturing problems.

Figure 1. TGA - RESIDUAL VOLATILES (Suspect vs. Control Wire)

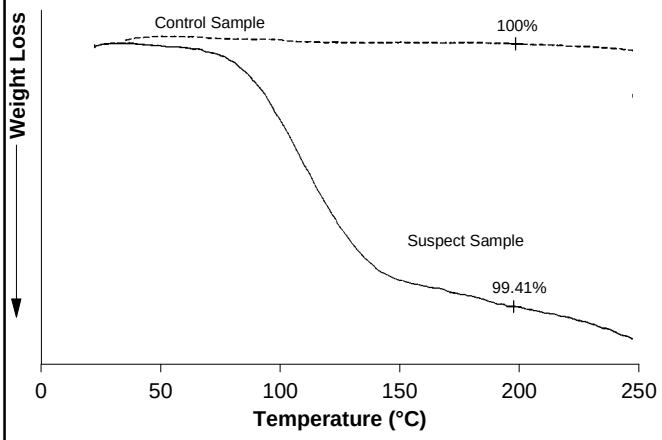


Figure 2. FTIR SPECTRA PEAK at 115°C vs NMP

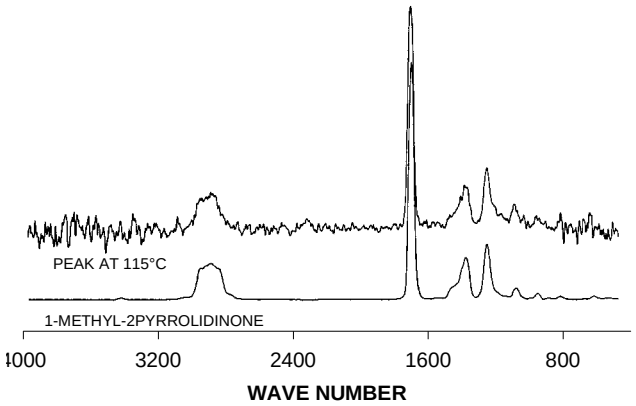


Figure 3. TMA - SOFTENING TEMPERATURE (Suspect vs. Control Wire)

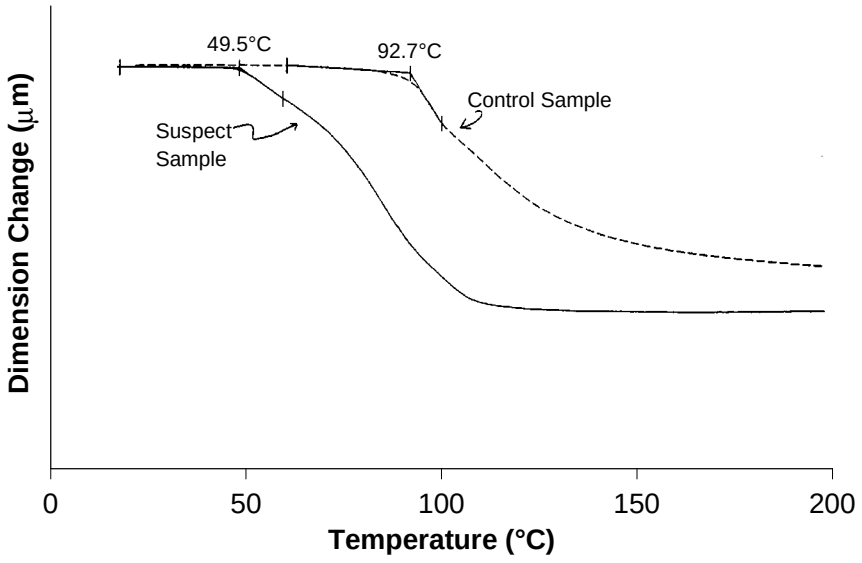
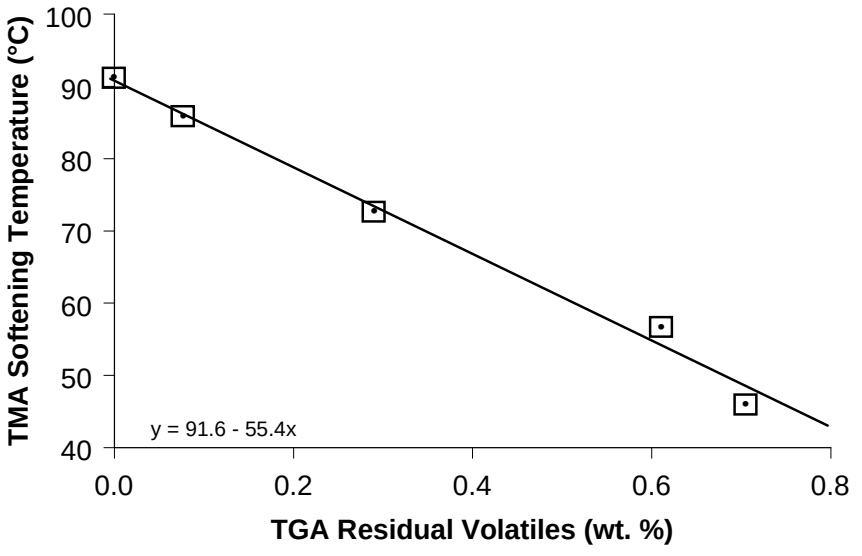


Figure 4. TMA Ts VERSUS TGA RESIDUAL VOLATILES (Wire Coatings)



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