SAE Inc. Standard No. 105
Electrical Resistivity of Latex-Based Products

ABSTRACT

This test method is used to evaluate the electrical resistivity of SAE's cured latex-based products, such as the ConduDisc or ConduFlow. Samples are clamped between copper plates and energized using a DC power supply. The resistance, resistivity, and conductivity of the material are measured.

1. EQUIPMENT REQUIRED

1.1 Programmable DC power supply
1.2 Timer
1.3 Vernier caliper
1.4 Clamps
1.5 Band saw
1.6 Copper plates
1.7 PVC sheets

2. SAMPLE PREPARATION

2.1 Prepare the latex-based product for testing (i.e. ConduDisc, ConduFlow, etc.) and pour into a 4"x8" cylinder coated with a thin layer of petroleum jelly, which will act as a mould release agent.
2.2 After one week remove the test sample from the cylinder and wipe surface of the sample with mineral spirits to remove any excess petroleum jelly, which will inhibit the cure.
2.3 Allow the sample to cure for an additional three weeks, four weeks total.
2.4 Using the band saw trim both ends of the test sample so that the surface is smooth and flat.
2.5 Then use the band saw to cut the cylinder into sections approximately 1" thick.
2.6 Each sample should be cut into three to five sections (specimens). Label the samples accordingly.

3. TEST SETUP

3.1 Set up a DC power supply so that one of the channels can reach 30 volts and three amps.
3.2 Place the specimen to be tested in between two flat copper plates.
3.3 Connect the positive lead to one of the copper plates and the negative lead to the other copper plate.
3.4 Place a PVC sheet or other insulating material underneath the bottom copper plate. Place a PVC sheet on the top copper plate and clamp the copper plates together around the specimen to ensure that the copper plates are in full contact with the surface of the sample.

4. PROCEDURE

4.1 Simultaneously start the timer and turn on the power supply.
4.2 When the timer reaches two minutes record the voltage and current displayed on the power supply display.
4.3 Turn off the power supply and unhook the leads.
4.4 Measure and record the surface area of the specimen using the Vernier caliper (specimen diameter).
4.5 Measure and record the distance between the copper plates using the Vernier caliper (specimen thickness).

5. CALCULATIONS

5.1 Calculate and record the resistance of the specimen:

$$R = \frac{V}{I}$$

where,
R is the resistance (ohms)
V is the voltage (volts)
I is the current (amps)

5.2 Once the resistance of the specimen has been determined calculate the resistivity:

$$p = R \times \frac{A}{d}$$

where,
p is the resistivity (ohm·cm)
R is the resistance (ohms)
A is the surface area in cm^2 ($A = \pi r^2$)
d is the distance between the copper plates (sample thickness) in cm

5.3 The conductivity of the specimen is the inverse of the resistivity:

$$\sigma = \frac{1}{p}$$

where,
σ is the conductivity (S/cm)
p is the resistivity (ohm·cm)

5.4 Calculate the average resistance of the sample from the resistances of the 3–5 specimens:

$$R_{average} = \frac{\sum R_n}{n}$$

where,
$R_{average}$ is the average resistance of the sample (ohms)
$\sum R_n$ is the sum of the specimen resistances (ohms)
n is the number of specimens

5.5 Calculate the average resistance of the sample from the resistances of the 3–5 specimens:

$$p_{average} = \frac{\sum p_n}{n}$$

where,
$p_{average}$ is the average resistivity of the sample (ohm·cm)
$\sum p_n$ is the sum of the specimen resistivities (ohm·cm)
n is the number of specimens

5.6 Calculate the average conductivity of the sample from the average resistivity of the sample:

$$?_{average} = \frac{1}{p_{average}}$$

where,
$?_{average}$ is the average conductivity of the sample (S/cm)
$p_{average}$ is the average resistivity of the sample (ohm·cm)

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