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Accelerated Aging of Pressure Sensitive Tape

1. DEFINITION

1.1 This method provides one environment in which to expose finished pressure sensitive tape material for the purpose of accelerating the aging of it. It is applicable to tape in roll form. It does not provide for a conclusion within itself, but is for use in conjunction with appearance or physical property tests to be conducted prior to and after the accelerated aging exposure. It is generally applicable to all types of pressure sensitive tapes with the possible exception of electrical grade tapes (see ASTM D-1000).

2. SIGNIFICANCE

2.1 This method accelerates natural aging of pressure sensitive tapes so that the response to the physical property tests changes to the same extent as with an exposure to at least 2 years of natural aging when compared with the response to test before aging.

2.1.1 Natural aging in this context means a continuous period of aging of tape in a closed fiberboard container (in darkness) in the variable climate of either the warm moist south, the warm dry southwest, or the moderate mid-continent, USA.

2.2 The extent of change for one physical property could be expected to be different than for another property and so would also relate to different natural aging time.

2.3 An abnormal product lot may cause differences in testing response that throw off the expected time patterns.

2.4 Appearance of normal tape product will usually change only slightly in 2 years natural aging. This accelerated exposure usually produces an exaggerated change in appearance that would be seen under natural conditions only in abnormal product.

2.5 There is no present experience to relate this accelerated exposure to responses to tape in applications where the tape is under an in-use stress.

3. TEST SPECIMEN

3.1 The sample should consist of rolls of tape.

3.1.1 The quantity of tape in any sample roll need not be more than necessary to supply the specimens for the physical property tests to follow the exposure.

3.1.2 No sample roll should be less than 12 mm (1/2") in width.

3.1.3 Sample rolls should be originally wound, not rewound rolls.

4. EQUIPMENT

4.1 A vessel to contain a solution of ammonium sulfate and tape undergoing exposure. The vessel must meet the following requirements:

4.1.1 Vented to allow equilibrium with an opening no greater than pinhole size.

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4.1.2 The air volume over the solution to be not more than 10% greater than the cube of the square root of the liquid surface area.

4.1.3 The air depth of the vessel to the liquid surface to be not more than 10% greater than the square root of the liquid surface area.

4.1.4 A desiccator assembly with a perforated plate can be a suitable vessel.

4.2 An oven of the forced-convection type maintained at a mean of 65.5°C ± 1°C (150°F ± 2°F).

4.3 The purity of the reagents used shall be reagent grade. Other grades may be used, provided it is first ascertained that the reagent is of sufficient high purity to permit its use without lessening the accuracy of determination.

4.4 Ammonium sulfate $(NH_4)_2SO_4$.

4.5 Water, distilled or demineralized.

4.6 The reagents of 4.4 and 4.5 are to be dissolved in the proportion of 1:1 by weight. Use a volume (the units will be cubic centimeters) of water not less than that obtained by multiplying 500 times 132 times the vessel air volume in cubic meters. This gives 500 times the number of grams of water required to humidify the air volume to 80% relative humidity at 65.5°C (150°F) and should supply the moisture required to accommodate the absorption by the sample rolls. This provides a saturated solution which will remain saturated at 65.5°C (150°F). This solution within the closed vessel both provides and controls the moisture content (humidity) within the vessel.

Note:
An oven or chamber (environmental) capable of maintaining a set temperature of 65.5°C ± 1°C (150°F ± 2°F) and 80% ± 2% relative humidity may be used as alternate conditioning equipment.

5. TEST METHOD

5.1 Place the sample rolls above the solution in the vessel so that roll edges lie in a horizontal plane (parallel with the liquid surface).

5.1.1 Include no more sample rolls than will displace one-fourth of the air volume in the vessel.

5.1.2 Arrange the sample rolls so that all surfaces are exposed to the humid air in the vessel. Use separators that allow free air space around and between the rolls and which are non-hygroscopic. Figure 1.

5.2 Close the assembly and place in the oven.

5.2.1 Assure that care is taken to prevent the solution from wetting any part of the assembly (including tape), other than the reservoir it occupies, when the assembly is moved in and out of the oven. This reduces salt deposition and crystalline buildup.

5.3 Remove the assembly from the oven after 96 hours. Immediately remove the sample rolls from the assembly.

5.4 Condition the sample rolls at standard conditions (Appendix A) for a minimum of 4 hours with free space around them.

5.5 After at least 4 hours of conditioning (some test materials may require 24 or 48 hours to reach equilibrium), remove at least three wraps but no more than six wraps of tape from the roll, then unwind several wraps of tape from the roll at 500-750 mm per second (20 to 30"/s) while allowing the roll to turn freely. Observe this unwound tape for adhesive stringiness or loosening and note any tearing, breaking, or delamination of the backing.

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5.6 Remove additional specimens as described in 5.5 for any tests specified.

6. REPORT

6.1 Report any pertinent observations while performing paragraph 5.5.

6.2 Report the value(s) found while performing paragraph 5.6.

Another method for determining the accelerated aging characteristics of pressure sensitive tapes is ASTM D 3611.

Figure 1: Vessel assembly.

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