Designation: D7271 – 06 (Reapproved 2012)

Standard Test Method for Viscoelastic Properties of Paste Ink Vehicle Using an Oscillatory Rheometer[1]

This standard is issued under the fixed designation D7271; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the procedure for determining the viscoelastic properties of printing ink vehicles by measuring the G', G", and tan delta using a controlled strain cone and plate oscillatory rheometer.

1.2 This test method provides the flexibility of using several different types of rheometers to determine viscoelastic properties in ink vehicles.

1.3 This test method is not intended for systems that are volatile at procedure temperatures as evaporation may occur effectively changing the percent solids before testing is finished and significantly altering the rheology.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions:* [3]

3.1.1 *frequency sweep test, n*—most rheometers have programs specific for their instrument.

3.1.1.1 *Discussion*—The user provides a specified geometry, frequency range, strain % or oscillatory stress and temperature of the test. This test will produce the data required for this method.

3.1.2 *G', n*—the elastic (storage) modulus obtained from an oscillatory test represents the energy stored during each frequency cycle, where the stress is divided by the corresponding linear elastic strain.

3.1.3 *G", n*—the viscous (loss) modulus obtained from an oscillatory test represents the amount of energy lost during each frequency cycle or the imaginary part of the complex modulus (for shear).

3.1.4 *geometry, n*—the cone used in the test.

3.1.5 *shear strain, n*—relative deformation in shear; term often abbreviated to shear.

3.1.6 *shear stress, n*—the component of stress parallel to (tangential to) the area considered.

3.1.7 *strain, n*—the measurement of deformation relative to a reference configuration.

3.1.8 *tan delta*(δ), *n*—the ratio of G" (viscous modulus) to G' (elastic modulus).

3.1.9 *viscoelasticity, n*—the phenomena exhibited by a liquid when energy is applied and once the force is released, the liquid recovers towards its original state by means of stored energy.

4. Summary of Test Method

4.1 Apply the ink vehicle to the plate of a rheometer.

4.2 Select the geometry (cone) and set to the required gap to the plate.

4.3 Remove the excess vehicle with the ink spatula.

4.4 Set the required temperature, strain or stress and frequency range for the frequency sweep. (Most rheometers have a test sequence that can be pre-prepared.)

4.5 Allow five minutes for temperature calibration and the vehicle to relax to its lowest energy state.

NOTE 1—Do not run a pre-shear sequence as this may affect results.

4.6 Start the frequency sweep test.

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.37 on Ink Vehicles

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Many of the definitions came wholly or in part from "An Introduction to Rheology," H.A. Barnes, J.F. Hutton, and K. Walters, Elesevier, 1989.