Designation: F904 – 22

Standard Practice for Separation of Plies for Bond Strength of Laminated Flexible Materials[1]

This standard is issued under the fixed designation F904; 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 practice describes techniques for separating plies of laminates made from flexible materials such as cellulose, paper, plastic film, and foil to enable the measurement of the bond strength or ply adhesion of the laminate. This includes laminates made by various processes: adhesive laminates, extrusion coatings, extrusion laminates, and coextrusions.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in 6.1.1.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F88 Test Method for Seal Strength of Flexible Barrier Materials

E171 Practice for Conditioning and Testing Flexible Barrier Packaging

3. Terminology

3.1 *Definitions:*

3.1.1 *bond strength*—amount of force or energy required to separate plies of material or materials plus the force to bend the plies.

4. Summary of Practice

4.1 This practice describes three general techniques that can be used to initiate separation of any two plies to facilitate a bond strength measurement. Three techniques are described for use with samples that do not have a non-laminated edge. Technique A describes various forms of mechanical separation. Techniques B and C involve the use of heat or solvents to separate the plies. The separated plies of the test specimen may be placed into the grips of a tensile testing machine to determine the force (or energy) required to further separate the plies, which is defined as bond strength.

5. Significance and Use

5.1 Laminates are made by bonding together two or more layers of material or materials, where each layer might be a single or multi-layer material. When the bonding agent is reactive and requires time to reach full performance, the bond strength is typically measured as a green (un-cured) bond and a cured bond. For processes that intentionally create a non-laminated edge, that edge is generally used to initiate the bond strength measurement. The techniques described in this practice can be used to initiate separation of plies when a non-laminated edge is not present.

6. Reagents and Materials

6.1 *Solvents*—Toluene, ethyl acetate, MEK (2-Butanone) THF (tetrahydrofuran), or water, or other suitable solvent to weaken the bond between layers sufficiently so that ply separation may be started.

6.1.1 **Warning—***Use of these solvents requires that appropriate safeguards be used to avoid hazards of skin contact, inhalation, and flammability.*

7. Sampling and Test Specimens

7.1 Depending on the nature of the sample being evaluated, the size of the sample, and the reason for evaluation, separating the plies in more than one location may be warranted.

[1] This practice is under the jurisdiction of ASTM Committee F02 on Primary Barrier Packaging and is the direct responsibility of Subcommittee F02.20 on Physical Properties.

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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.