



Designation: D 5028 – 96

Standard Test Method for Curing Properties of Pultrusion Resins by Thermal Analysis¹

This standard is issued under the fixed designation D 5028; 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 determination of curing parameters of pultrusions resins by differential scanning calorimetry.

1.2 This test method is applicable to pultrusion resin solutions with adequate initiator(s).

1.3 The normal operating temperature range is from 0 to 200°C.

NOTE 1—Resin systems which do not form an adequate baseline are not covered by this test method.

1.4 Computer or electronic based instruments or data treatment equivalent to this practice may also be used.

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.* For specific hazard statements, see Note 1.

NOTE 2—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

D 3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis²

D 3918 Definitions of Terms Relating to Reinforced Plastic Pultruded Products²

E 473 Terminology Relating to Thermal Analysis³

E 967 Practice for Temperature Calibration of Differential Scanning Calorimeters and Differential Thermal Analyzers³

3. Terminology

3.1 Definitions:

3.1.1 *onset temperature*—an extrapolated point representing an intersection of the baseline and the front slope of the exothermic curing curve.

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.18 on Reinforced Thermosetting Plastics.

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² Annual Book of ASTM Standards, Vol 08.02.

³ Annual Book of ASTM Standards, Vol 14.02.

TABLE 1 DSC Indium Calibration Summary

Participant	Measured Indium Melting Point	Correction Factor	DSC Instrumentation
Ashland	157.8	–1.2	duPont 9900
Cargil	156.3	+0.3	Perkin Elmer DSC 4
Dow Chemical	158.8	–2.2	duPont 1090
Koppers	157.7	–1.1	Perkin Elmer DSC-2C
MMFG	156.4	+0.2	Omnitherm QC .25
OCF	156.0	+0.6	duPont 1090
PPG	157.0	–0.4	Perkin Elmer 7
R. D. Werner	155.6	+1.0	Omnitherm QC .25
Indium Standard	156.6	—	

3.1.2 *peak temperature*—an extrapolated point representing an intersection of both front and rear slopes of the exothermic curing curve.

4. Summary of Test Method

4.1 The test method consists of heating of the test material at a controlled rate of temperature increase in a controlled

TABLE 2 On-Set Temperature Precision Data Calculations Based on “Original” Test Values

Material	Mean Average, $\bar{X}$	Overall Relative Standard Deviation of Precision Test Method, V_{Rt} %	Repeatability Interval, I_r	Repeatability Interval, I_R
1	93.07	0.815	2.148	4.381
2	92.47	0.751	1.967	4.171
3	95.32	0.729	1.967	4.370
4	96.35	0.582	1.585	5.697
5	102.82	0.878	2.558	4.222
6	102.41	0.400	1.160	4.590

TABLE 3 Peak Temperature Precision Data Calculations Based on “Adjusted” Test Values

Material	Mean Average, $\bar{X}$	Overall Relative Standard Deviation of Precision Test Method, V_{Rt} %	Repeatability Interval, I_r	Repeatability Interval, I_R
1	92.72	0.818	2.148	3.784
2	92.12	0.754	1.967	2.635
3	94.97	0.731	1.967	3.354
4	96.00	0.584	1.585	4.587
5	102.47	0.882	2.558	3.068
6	102.06	0.401	1.160	2.270