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IPC-TM-650
TEST METHODS MANUAL

Number	
2.4.38	
Subject	
Prepreg Scaled Flow Testing	
Date	Revision
6/91	**A**
Originating Task Group	
N/A	

1.0 Scope This procedure defines a test method used to determine the scaled flow parameters of an epoxy resin, pre-impregnated glass fabric (prepreg). The test is appropriate for checking material consistency, but is not solely intended for defining the suitability of prepreg to be used in a specific printed wiring board product or process.

2.0 Terms and Definitions

2.1 Scaled Flow Parameter Test A test procedure intended to measure multilayer lamination prepreg flow characteristics.

3.0 Apparatus

3.1 Test Specimen The prepreg specimen size shall be 5.50 ± 0.05 inches by 7.00 ± 0.05 inches. Specimens shall be cut with the 7 inch dimension parallel to the machine (warp) direction.

3.2 Release Material The release material shall be polyvinyl fluoride (PVF) or equivalent at least 7 x 9 inches in size.

3.3 Tape Tape shall be suitable for holding the sample during processing.

3.4 Press Plate The press plate used shall be metal between 0.125 to 0.250 inches thick, and 4.50 ± 0.01 x 6.00 ± 0.01 inches in size. The plate shall be flat and parallel within 0.001 inches.

3.5 Lamination Press A lamination press with a minimum platen size of 8 x 8 inches, capable of applying a uniform pressure of 840 lb force (31.0 PSI) ± 5% and capable of maintaining a temperature range of 120-180°C with a tolerance of ± 2° of required temperature.

3.6 Prepreg Cutting Equipment Cutter capable of maintaining tolerances defined in 3.1.

3.7 Balance A balance capable of weighing to ± 0.01 gram.

3.8 Micrometer A measuring instrument for measuring thickness to ± 0.0001 inch.

3.9 Desiccator A stabilization chamber (drying cabinet) with significant desiccant (calcium sulfate or equivalent) capable of maintaining less than 10% relative humidity at 21 ± 2°C (70 ± 5°F).

4.0 Test Procedure

4.1 Specimen Conditioning The specimens shall be cut to size and then placed in a stabilization chamber (see 3.9) for a period of 24 hours. Testing shall be performed within 15 minutes of removal from chamber. *Note:* Specimens tested within 15 minutes of their manufacture need not be desiccated.

4.2 Specimens shall be gathered into a stack for test purposes. Number of plies shall be determined from Table 1.

Table 1

Glass Thickness	Number of Plies (stack-up)
Up to 0.0025 in. (i.e., style 104, 106, 108, etc.)	18-20
*Greater than 0.0025 in (i.e., style 112, 113, 116, etc.)	10

Note: Glass styles thicker than style 116 have shown some difficulty in consistency of test results.

4.3 Weigh stack of prepreg to the nearest 0.01 gram, record weight as Wo.

4.4 Center press plate (see 3.4) on the laminating press platen. Close press and preheat lamination press (see 3.5) and press plate to 150 ± 2°C. (Other temperature can be used as agreed upon by user and vendor.)

4.5 Place the stack of prepreg on one of the release sheets (see 3.2) which has been previously cut to a 7 x 9 inch size. Use tape to hold the sample in place. Position tape on opposite corners, such that it does not interfere with the 4.5 x 6.0 inch specimen center to be tested. The second release sheet is placed on top of the stack to form a sandwich. See Figure 1.

4.6 Open press and immediately place the stack sandwich on the press plate, being careful to center the stack on the press plate. *Note:* Make sure that the release material is in place.

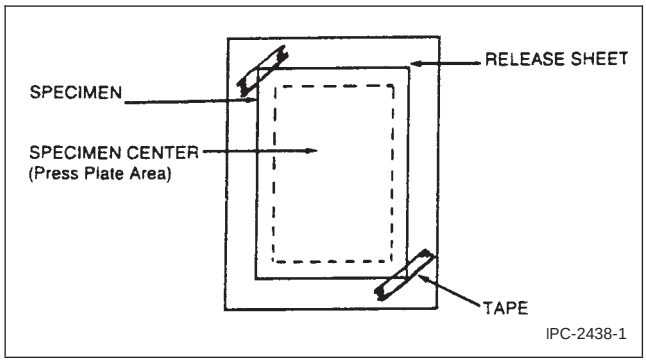

Figure 1

4.7 Unless otherwise specified, press the specimen with a force of 840 lb (31.0 psi) ± 5% for 10 minutes minimum. Full force is to be applied within 15 seconds after sample is placed on the press plate.

4.8 Carefully remove the hot specimen from the press, flip over onto a smooth flat surface and cool for 5 minutes or to a rigid state before making measurements.

4.9 Remove release material from stack. Using the template shown in Figure 2, mark the points to be measured. Cut the stack when required to facilitate measuring the specific points along the cut line shown in Figure 2.

5.0 Test Results

5.1 Measure the thickness to the nearest 0.0001 inch with a micrometer at the three intervals defined by the template. Record all three measurements for each test specimen. If there is a thickness variation between the three measurements of 0.003 inches or more, the test must be repeated. Average the three measurements to determine final measured thickness.

5.2 Use the initial weight, WO, to determine the initial thickness (Ho) either from the formula in Appendix or from Table 2.

5.3 Final thickness per ply can be calculated by dividing the final measured thickness by the number of plies. Initial thickness and final thickness can be used to calculate thickness change.

Appendix

Determination of Initial Thickness: (See Table 2)

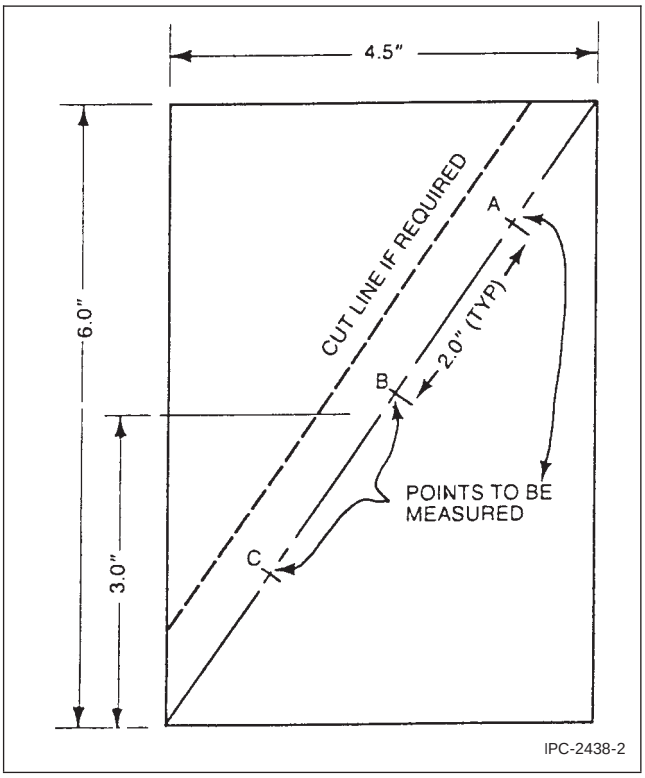

Figure 2

$$ho = \left[\frac{Wo}{n}(5.54 \times 10^{-2}) - \right] 2.12 \times 10^{-2}$$

Where:

ho = Initial thickness per ply (mils)

Wo = Initial stack weight (g)

Wg = Unit glass weight (g/in2)

n = Number of plies

Unit Glass Weights: (Approximated from test results)

Style	Weight (g/in2)
104	0.0128
106	0.0164
108/1080	0.0311
112/2112	0.0464
113/2113	0.0538
116/2116	0.0691
7628	0.1312

Table 2 Initial Stackweight (Wo, grams) vs. Calculated Initial Thickness (ho, mils)

104		106		108		112		113		116		7628	
Wo	ho	Wo	ho	Wo	ho	Wo	ho	Wo	ho	Wo	ho	Wo	ho
20	1.03	25	1.28	40	1.95	35	3.13	35	2.97	45	3.82	80	6.71
21	1.10	26	1.35	41	2.02	36	3.24	36	3.09	46	3.94	81	6.73
22	1.16	27	1.41	42	2.08	37	3.36	37	3.21	47	4.06	82	6.85
23	1.23	28	1.48	43	2.15	38	3.48	38	3.32	48	4.17	83	6.97
24	1.29	29	1.54	44	2.21	39	3.60	39	3.44	59	4.29	84	7.08
25	1.36	30	1.61	45	2.28	40	3.71	40	3.56	50	4.41	85	7.20
26	1.43	31	1.68	46	2.34	41	3.83	41	3.67	51	4.52	86	7.32
27	1.49	32	1.74	47	2.41	42	3.95	42	3.79	52	4.64	87	7.44
28	1.56	33	1.81	48	2.47	43	4.07	43	3.91	53	4.76	88	7.55
29	1.62	34	1.87	49	2.54	44	4.18	44	4.03	54	4.88	89	7.67
30	1.69	35	1.94	50	2.60	45	4.30	45	4.14	55	4.99	90	7.79
31	1.75	36	2.00	51	2.67	46	4.42	46	4.26	56	5.11	91	7.91
32	1.82	37	2.07	52	2.73	47	4.54	47	4.38	57	5.23	92	8.02
33	1.88	38	2.13	53	2.80	48	4.65	48	4.50	58	5.35	93	8.14
34	1.95	39	2.20	54	2.86	49	4.77	49	4.61	59	5.46	94	8.26
35	2.01	40	2.26	55	2.93	50	4.89	50	4.73	60	5.58	95	8.38
36	2.08	41	2.33	56	2.99	51	5.01	51	4.85	61	5.70	96	8.49
37	2.14	42	2.39	57	3.06	52	5.12	52	4.97	62	5.82	97	8.61
38	2.21	43	2.46	58	3.13	53	5.24	53	5.08	63	5.95	98	8.73
39	2.27	44	2.52	59	3.19	54	5.36	54	5.20	64	6.05	99	8.85
40	2.34	45	2.59	60	3.26	55	5.48	55	5.32	65	6.17	100	8.96
41	2.40	46	2.65	61	3.32	56	5.59	56	5.44	66	6.29	101	9.08
42	2.47	47	2.72	62	3.39	57	5.71	57	5.55	67	6.40	102	9.20
43	2.53	58	2.78	63	3.45	58	5.83	58	5.67	68	6.52	103	9.32
44	2.60	59	2.85	64	3.52	59	5.95	59	5.79	69	6.64	104	9.43
45	2.66	50	2.91	65	3.58	60	6.06	60	5.91	70	6.76	105	9.55

Wo = grams, ho = mils; (n) for 104, 106, 108 = 18; (n) for 112, 113, 116 7628 = 10

Reference Documents

1. Journal of Elastomers and Plastics, 10,367 (1978), C.J. Bartlett
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3. IPC-TP-281, The Use of Scaled Flow Testing for B-Stage Prepreg, C.J. Bartlett, D.P. Bloechle, W.A. Mazeika
4. IPC-TP-418, Application of Scaled Flow Testing as an Incoming Inspection Criteria, H.J. Brown
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6. D.P. Bloechle, ‘‘Epoxy Prepreg Characterization using Scaled Flow Testing Techniques,’’ Circuit World, 9,1 (1982), p.8