



IT-180ABS/IT-180ATC

High Tg, Low CTE, Multifunctional Epoxy Resin Laminate & Prepreg

Process Guideline

These process guidelines are the ITEQ interior test experience. We believed that should have helps for the PCB manufacturer. Especially, for those print circuit board manufacturers who first time apply this material. But these experiences will be unable to cover all rank of designs and applications, as well as print circuit board fabrication equipments, chemicals and technologies. The suggestions must pass through initial trial run to set up the process, and then the basis actual test results carried on the working condition and the revision.

1. Material Handling & Storage

- (1) Shelf life is at least three months when prepreg stored in a cool dry environment (Temperature less than 23°C and Humidity less than 60%RH). Six months shelf life under 5°C.
- (2) Prepreg should exposed to well humidity and temperature controlled environment.
- (3) Prepreg should be stored in controlled environment for 12 hours before to use.
- (4) Prepreg supplied in rolls or panels should be stored horizontally. To avoid damage, no stacking is recommended.
- (5) Laminates should be stored in a dry environment.
- (6) Laminate should always be stored flat.

2. Inner Layer & Copper Treatment

- (1) Scaling factors may performer differently by laminate thickness, as well as the ration of remnant copper. First article must be run before mass production to determine suitable compensation factor.
- (2) The inner layers should be put in a temperature and humidity controlled room for 8 hours before punching guide hole and AOI. That attribute to better dimension stability and registration purpose.
- (3) Inner layers should be baked for 40 minutes at 120°C at least after black or brown oxides treatment.
- (4) We strongly suggest to re-new fresh rinse water of DES lines and brown/black oxide lines, that would help to against CAF(Conductive Anode Filament) problem. An abundant of metallic ions and other pollution remain in the tanks, that maybe cause CAF failure.

3. Lamination Overview

- (1) Stacks must be prepared in a temperature and humidity controlled lay-up room to avoid moisture absorption.
- (2) It is recommended to apply vacuum for 10-30 minutes before temperature ramping up. Vacuum hydraulic machine is recommended for lamination process. The heating raise by thermal couple is $1.5\sim 2.5^{\circ}\text{C}/\text{min}$ from 80°C to 140°C and keep the temperature at 185°C above for more than 60 minutes is necessary. Full pressure is 300-400 psi. Cooling rate below $3^{\circ}\text{C}/\text{min}$ is recommended as shown in **Figure 1**.

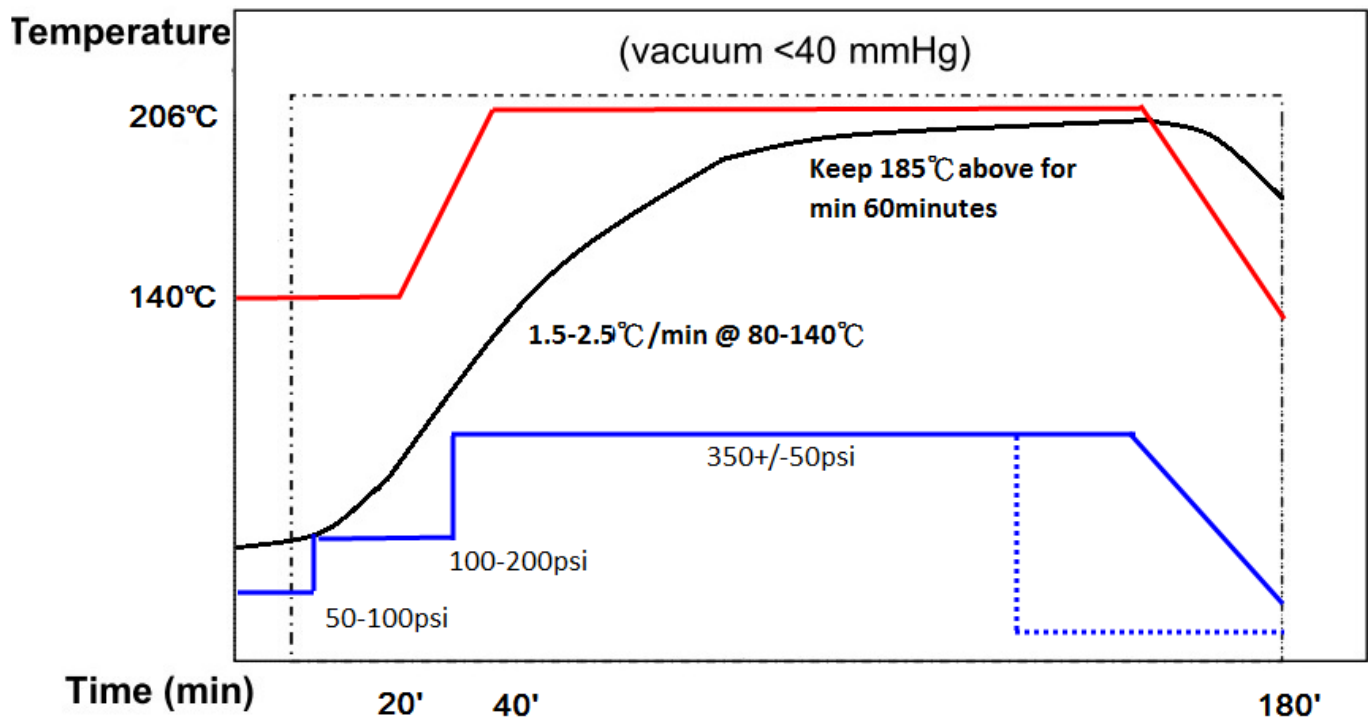


Figure 1. Recommended press cycle

- (3) For those PCB manufacturers who use hot start (more than 180°C), lowering 25-50 psi is proper. However, for some of PCB manufactures may be proper to get pressure drop for 100 psi that is also workable. Provide full pressure at $90\text{-}120^{\circ}\text{C}$ by product temperature (not platen temperature) is recommended.
- (4) The resin flow properties of this material would help to filled resin for heavy copper application, thus we suggest setup even higher level than above recommended press cycle, and please making cross section to check if the glass fiber sticks on the inner layer copper, especially for more than 2oz inner layer. 5um butter core at least or more is recommended and it will enhance thermal reliability.
- (5) For the construction of multi-ply ultra heavy glass (7628) and with ultra high resin content, we estimate that have more resin flow of the board edge, but doesn't influence the reliability, however, we suggest to use bigger copper foil or to move the full pressure down, that could be avoid resin to stick steel platen.
- (6) The dynamic viscosity at $1.5\text{-}3^{\circ}\text{C}/\text{min}$ (**Figure 2.**) are shown as below for user's reference.

(7) Each single press will possibly have different temperature rise curve. Therefore, to trace heat rise and Tg in middle and outer laminates with thermal couple as well as cross section which can confirm the results are reliable.

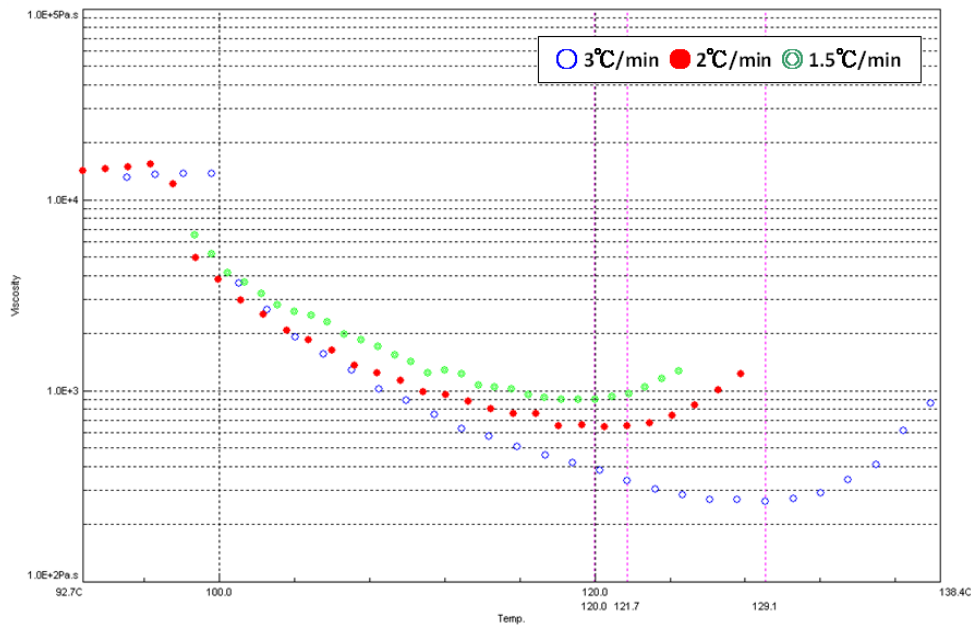


Figure 2. Dynamic viscosity at 1.5-3°C/min

4. Drill Process

- (1) We suggest to use undercut drill bit for the hole size less than 1.2mm hole size. The hit counts for hole size less than 0.5mm (20mil) would be around 500-1000 hits. Hole size larger than 0.5mm can be up to 800-1500 hits.
- (2) Standard Aluminum entry board and backup board work well.
- (3) Heavy copper (inner layer copper thickness $\geq 3\text{oz}$), higher layer boards, thick boards or multi-ply ultra heavy glass fiber (7628), we suggest to use lubricate Aluminum entry board would help for reduce heat in the hole. The parameters that are with lower speed and lower infeed and retract would be helpful for hole wall quality.
- (4) Please make sure the dirt and dust are drawn into a vacuum suction. It would be helpful to against gouging in the holes.
- (5) Baking at **170°C** for 2 hours after drilling process to soften the smear maybe helpful for smear removal. (Some one bake the boards before plasma or desmear that looks good for higher layer and thick boards)
- (6) Stack height is according to the board construction and overall thickness and aspect ratio.
- (7) Below table lists the series parameters are just for user's reference, we assume the board thickness is around 0.080 inch. It needs to be fine tune for different tools, board constructions, board thickness, layers and copper weights.
- (8) After drilling process, using air guns blow the boards to avoid hole plug.
- (9) According to internal tests, if occurs the perpendicular resin crack happened after thermal stress, use higher chiploads for this material maybe can improve resin crack issue.
- (10) For higher layers, thick or heavy copper boards, peak drilling (two to three steps) maybe necessary to drive to high quality drilling performance, including roughness, nail head, smear, even attribute to IP/ICD problem.

Table 1. Drill parameter for reference.

Drill Size		Spindle	Surface Speed		Infeed		Chipload		Retract	
inch	mm	KRPM	SFPM	SMPM	in/min	m/min	mil/rev	um/rev	in/min	m/min
0.0098	0.25	100	258	79	63	1.6	0.63	16	591	15
0.0118	0.3	95	294	90	63	1.6	0.66	17	787	20
0.0138	0.35	85	307	93	63	1.6	0.74	19	984	25
0.0157	0.4	85	350	107	63	1.6	0.74	19	984	25
0.0177	0.45	80	371	113	63	1.6	0.79	20	984	25
0.0197	0.5	80	412	126	79	2.0	0.98	25	984	25
0.0217	0.55	80	454	138	79	2.0	0.98	25	984	25
0.0236	0.6	80	495	151	79	2.0	0.98	25	984	25
0.0256	0.65	80	536	163	79	2.0	0.98	25	984	25
0.0276	0.7	68	491	150	79	2.0	1.16	29	984	25
0.0295	0.75	68	526	160	71	1.8	1.04	26	984	25
0.0315	0.8	68	561	171	71	1.8	1.04	26	984	25
0.0335	0.85	58	508	155	71	1.8	1.22	31	984	25
0.0354	0.9	58	538	164	63	1.6	1.09	28	984	25
0.0374	0.95	58	568	173	63	1.6	1.09	28	984	25
0.0394	1	58	598	182	63	1.6	1.09	28	984	25
0.0413	1.05	47	509	155	63	1.6	1.34	34	984	25
0.0433	1.1	47	533	162	51	1.3	1.09	28	984	25
0.0453	1.15	47	557	170	51	1.3	1.09	28	984	25
0.0472	1.2	47	581	177	51	1.3	1.09	28	984	25
0.0492	1.25	47	606	185	39	1.0	0.84	21	984	25

5. Desmear Process

- (1) The desmear condition is very close to conventional high Tg phenoic cured materials. Regular Vertical or horizontal permanganate desmear equipment and chemical all work well for this material. But please pay attention to the throwing power capability of your machine and chemical. To do cross sections and SEM to check glass fiber and resin clean before/after desmear in the drilled through holes is necessary. Etching back of 0.1-0.3mil with three point interconnect would be helpful for reliability.
- (2) Plasma for this material is not necessary, except for higher layer, thick and heavy copper boards. When users use plasma to enhance the throwing power, please adjust the dwell time of permanganate desmear (if necessary) to prevent too much roughness though it maybe not affects the reliability.
- (3) Baking at 170°C for 2 hours after drill or de-burr process (before permanganate desmear) would be helpful for cleaning the smear at hole wall and inner layer coppers.
- (4) The following vertical desmear parameter as shown in (Table 2.) is for reference only. Users can consult with the chemical supplier for more information.

Table 2. Permanganate desmear for reference

Composition	Concentration	Temperature	Dwell Time
Sweller	20-30%	75-80°C	7-10 minutes
Mn ⁺⁷	100g/L	75-80°C	10-12 minutes
OH ⁻	0.9-1.1N	--	--

6. Safety and Health

As the edges of laminates may be sharp, be careful handling prepregs and laminates. Prepregs and laminate may create the dusts in the mechanical processes. If there is any unexpected affair, please refer to MSDS (Material Safety Data Sheets). When the mouse, nose and eyes are stained with pollution, please use a great deal of water to clean. Anyway, it is recommended that operators wearing glove, mask and goggles during operating.

The data shown above, are based on our interior test results that offer print circuit board manufacturers and designers initial period information. ITEQ believed that these experiences are useful and cover most of major PCB processes. However, ITEQ retains the right to update and renew the information for user's needs.