



**inEMI**<sup>®</sup>

International Electronics Manufacturing Initiative

# HFR-Free PCB Materials Initiative

Advancing manufacturing technology

# What the project involves 项目的定义

- This is not a Round Robin of Laminates不是层压板材的循环赛
- This is not “Good Vs. Bad” laminate project不是非“好”即“坏”的层压板项目
- This is not a “System” qualification project不是对“系统”进行质量认证的项目
- This will change the laminate datasheet将改变层压板的数据清单
- This will give quantifiable values to material properties and performance values将对材料属性和性能给出可量化的值
- This will modify existing test methods and may introduce new methods将修改现存的测试方法并可能引入新的方法
- This will be verifiable and impactful将是可验证的有效的

# PCB Material Areas of concern

## PCB材料所关注的问题

	<b>Areas of Concern</b>	<b>Comments</b>
	<b>Basic Materials Properties</b>	
1	Micro and macro hardness	Basic Material Properties have been measured and shown to be different from the Brominated Epoxy baselines. Test methods adopted from IPC/ASTM/other sources may be refined or modified to give a quantifiable value.
2	Glass transition temperature (Tg)	
3	Decomposition temperature (Td)	
4	Moisture absorption	
5	Fracture Toughness of Resin / Resin Cohesive Strength	
6	Stiffness	
7	Dk & Df	
8	Coefficient of thermal expansion (z-axis and x-, y-axes)	
9	Flexural strength	
	<b>Thermo-Mechanical Performance</b>	
10	Pad Cratering (brittle fracture)	Some Thermo Mechanical Properties have shown margin degradation from the Brominated Laminate baseline. Major concern focus is on the stiffness or brittleness of the laminate and how it will perform in the field. Higher occurrences of Pad Cratering during
11	Shock & Vibe and Drop test data	
12	Transient Bend	
13	Copper Pad Adhesion (CBP/Hot Pin Pull/ Shear or Tensile)	
14	CAF resistance	
15	Long term life prediction, such as IST or thermal shock test.	
16	Plastic and elastic deformation characteristics as function of stack-up, layer thickness, and temperature	
17	Co-Planarity Warpage characteristics as a function of stack-up, layer thickness, and temperature	
18	Delamination characteristics under mechanical or thermal stress conditions	
	<b>Process/Manufacturing</b>	
19	PCB fabrication process, drill wear, lamination & desmear cycle	Increased processing cost effecting the final cost of converting to HF products. Fillers and longer cycle times are a concern
20	Punchability/Scoring/Breakoff Performance	
	<b>Assembly Process</b>	
21	Lead Free Reflow Test	Assembly and Rework at Lead Free temperatures is a concern. Can not degrade Solder Joint Reliability
22	Rework (Pad Peeling)	
	<b>Other Concerns</b>	
23	Resin system dependency/hardening/curing agents	Other concerns or opportunities for changes that could positively affect the HF laminate options have been raised and will also be considered. These may be longer term thrust or follow on projects.
24	Affect of Fillers	
25	UL Fire ratings (V0-V1)	
26	Electrical Properties (UL CTI rating)	
27	MOT Maximum Operating Temperature	

# Basic Materials Properties 基本的材料属性

<b>Micro and macro hardness</b>
<b>Glass transition temperature (Tg)</b>
<b>Decomposition temperature (Td)</b>
<b>Moisture absorption</b>
<b>Fracture Toughness of Resin / Resin Cohesive Strength</b>
<b>Stiffness</b>
<b>Dk &amp; Df</b>
<b>Coefficient of thermal expansion (z-axis and x-, y-axes)</b>
<b>Flexural strength</b>

- **Basic Material Properties** have been measured and shown to be different from the **Brominated Epoxy** baselines.
- **Test methods** adopted from IPC/ASTM/other sources may be refined or modified to give a quantifiable value.



# Thermo-Mechanical Performance热 - 机械特性

<b>Pad Cratering (brittle fracture)</b>
<b>Shock &amp; Vibe and Drop test data</b>
<b>Transient Bend</b>
<b>Copper Pad Adhesion (CBP/Hot Pin Pull/ Shear or Tensile)</b>
<b>CAF resistance</b>
<b>Long term life prediction, such as IST or thermal shock test.</b>
<b>Plastic and elastic deformation characteristics as function of stack-up, layer thickness, and temperature</b>
<b>Co-Planarity Warpage characteristics as a function of stack-up, layer thickness, and temperature</b>
<b>Delamination characteristics under mechanical or thermal stress conditions</b>

- **Some Thermo-mechanical properties have less margin than brominated laminate baseline.**
- **Major focus is on the stiffness/brittleness of the laminate and how it will perform in the field.**
- **Higher Pad Cratering occurrences is a concern.**

PCB fabrication process, drill wear, lamination & desmear cycle  
Punchability/Scoring/Breakoff Performance

- **Increased processing cost effecting the final cost of converting to HF products.**
- **Fillers and longer cycle times are a concern**

Lead Free Reflow Test

Rework (Pad Peeling)

- **Assembly and Rework at Lead Free temperatures is a concern**
- **Can not degrade Solder Joint Reliability**

## Other Concerns其他问题

**Resin system dependency/hardening/curing agents**

**Affect of Fillers**

**UL Fire ratings (V0-V1)**

**Electrical Properties (UL CTI rating)**

**MOT Maximum Operating Temperature**

- **Other concerns or opportunities for changes that could positively affect the HF laminate options have been raised and will also be considered.**
- **These may be longer term thrust or follow on projects.**

## Test Suite Strategy 测试集测试策略

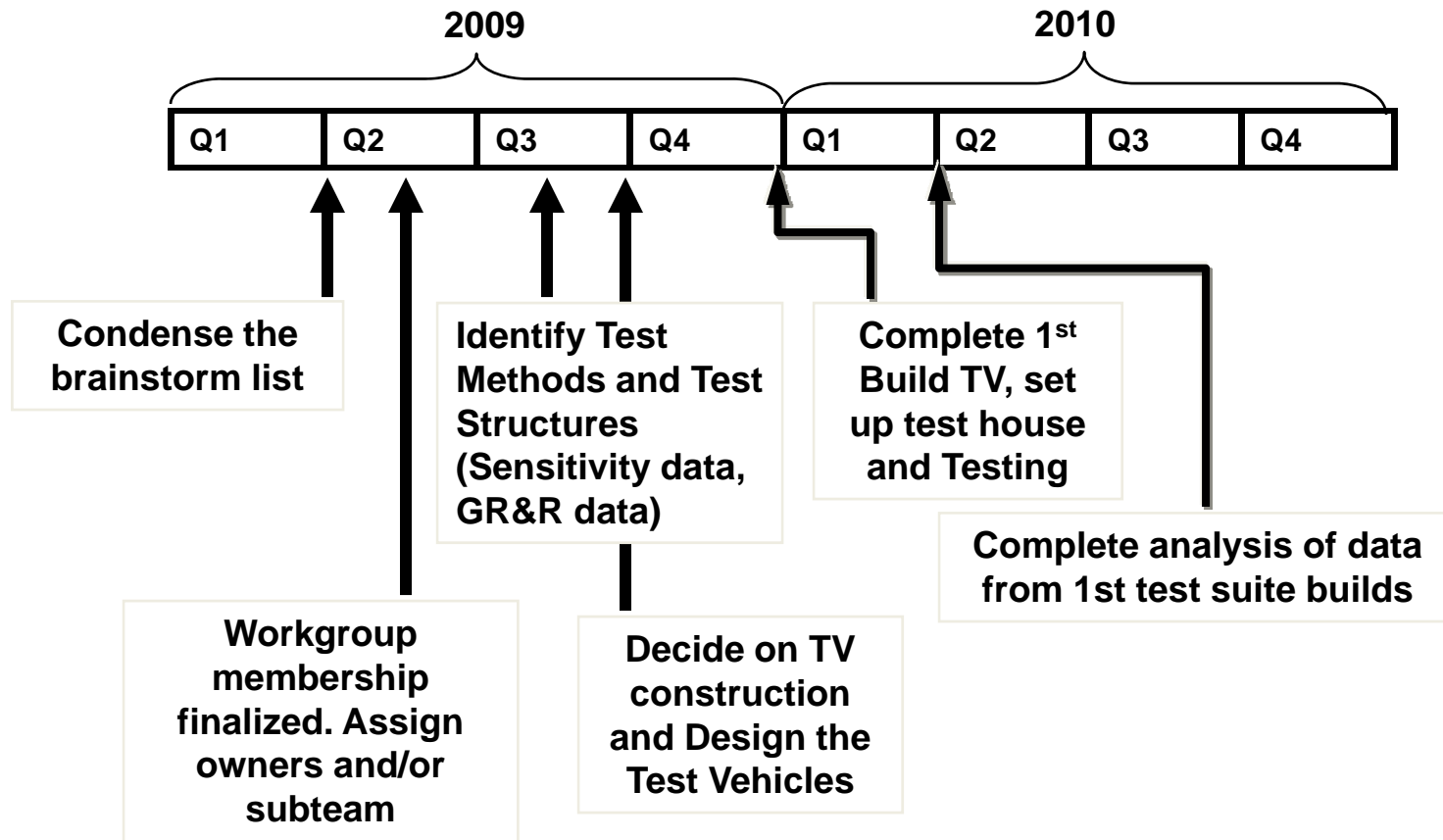
**Goal: To define and implement quantifiable data into the HF Laminate Suppliers Datasheets that will assist in material selection by users**

- 1. First step is to define all known HF performance degradation in systems. This is the underway and is the basis for our “Areas of Concern”.**
- 2. Define a System-like Test Suite. Will require Laminate & PCB supplier interactions.**
  - Define quantifiable Test Methods and test equipment to assess performance (linked to margin degradation levels)
  - Perform and correlate GR&R studies on Test Methods/Equipment
  - Develop Common Test Vehicles & Coupons (DT/MS Mobile)
  - Develop Desktop & Mainstream Mobile Test Vehicle Construction/Stack up
- 3. Set up test house (in-house or third party to be determined based on test equipment)**

## Test Suite Strategy 测试集测试策略

4. Consortia members will build, test and review the HF Material performance based on the Test Suite Methodology.
  - Correlation to Margin Degradation/Performance developed.
  - Possible re-iteration back to step 2 to refine some test methods
5. Set the draft Technology Envelope/Test Methods for HF Laminates
6. OEM/ODM will build Products to verify PCB Reliability, SJR and Assembly Yields of HF Laminates with in the Technology Envelope.
  - Acceptable level of Technology Envelope values will be set by each OEM/ODM
7. Incorporate Technology Envelope into laminate datasheet
8. Work with Supply Chain to verify Capability & Capacity of HF Laminate within Technology Envelope

# Proposed Timeline 时间表



# Summary 总结

- **This effort is quickly approaching the end of the definition phase**该项目已很快要结束其定义阶段。
  - **Need to complete definition of areas of concern**需要完成“所关注问题”的定义
  - **Statement of Work is being drafted**工作任务书在起草
- **The team is converging on key deliverables**项目成员汇聚在几个主要交付物上
  - **Definition of actual tests and test structures will be tackled after Statement of Work is closed**在SOW完成之后将讨论定义实际的试验和试验结构
  - **Characterization work, and resolving material differences, will follow later this year**有关特性工作、材料的差异等问题将在今年晚些时候开展



# INEMI<sup>®</sup>

International Electronics Manufacturing Initiative

Open Issues

*Martin Rausch*

Advancing manufacturing technology

# Presentations

[http://www.inemi.org/cms/projects/ese/HFR-Free\\_Leadership.html](http://www.inemi.org/cms/projects/ese/HFR-Free_Leadership.html)

