



iNEMI[®]

International Electronics Manufacturing Initiative

**iNEMI HFR-Free
Program Report**
**iNEMI无卤化阻燃剂
项目报告**

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Shenzhen

Advancing manufacturing technology

Outline

- **Why Eliminate Halogenated Flame Retardants** 为什么减除卤化阻燃剂 (HFR)的使用
- **Industry Development Programs** 业界的合作项目
- **iNEMI HFR-Free Activities** 概览iNEMI HFR-free项目
- **Summary** 总结

Materials Restriction材料限制

Short Term Needs - Identified in 2009 iNEMI Roadmap

- **A strategy and action plan to facilitate low risk conversion of high-reliability applications to Pb-Free solders 高可靠产品向无铅焊接的转换**
- **Prepare for possibility of additional substance restrictions under RoHS and/or REACH (HBCDD, phthalates) 更多的受限物质被列入RoHS和REACH**
- **Proactive programs to facilitate low risk conversion to halogenated flame retardant (HFR) - free and PVC-free material alternatives 具有前瞻性的项目来降低未来向无卤和无PVC材料的转换风险**
 - **The environmental concerns with PCB's containing halogenated flame retardants is that toxic dioxins may be produced during burning. 卤化阻燃剂材料燃烧时可能产生毒害物质破坏环境**

Industry BFR/PVC-Free Projects

Project Title	Project Chair	Key Objectives	Link for More Information	Expected Completion Date
HDPUG – Reliability of BFR/PVC-Free Notebook PWBs	Dell Wistron ITRI	Supply chain assessment of 100% BFR/PVC-Free Notebook PWBs (board + components) and reliability assessment	www.hdpug.org	Results expected in late 2009
HDPUG – BFR/PVC-Free Cables	Dell	Assess a broad range of BFR/PVC-Free materials for different cable and wire applications.	www.hdpug.org	Results and publication expected by early 2010
IPC – Halogen-Free Subcommittee (J-Std 709)	Intel/Dell	Develop a new BFR/PVC-Free standard (define maximum concentration values for halogens across a variety of applications, not just PCBs)	www.ipc.com	Re-ballot in summer 2009
US EPA - Flame Retardants in Printed Circuit Boards	EPA	Identify and evaluate commercially available flame retardants in FR-4 printed circuit boards and their environmental, human health and safety and environmental fate aspects.	http://www.epa.gov/dfepubs/projects/pcb/index.htm	Finalize report and publicize results in mid-2009
iNEMI - HFR-Free PCB Material Evaluation	Intel	Identify technology readiness, supply capability and standards development opportunities for “halogen-free” alternatives to conventional printed wiring board materials	www.inemi.org	Project completed in 2008 and presented at SMTAI



iNEMI HFR-Free Project Portfolio

Completed projects 已完成

- HFR-Free PCB Material Evaluation 无卤化阻燃剂PCB材料评估

Active projects 进行中

- HFR-Free High Reliability PCB 高可靠无卤化阻燃剂PCB
- HFR-Free Leadership Program 无卤化阻燃剂领导项目
 - HFR-Free PCB Materials (chaired by Intel & Cisco) 线路板材料
 - HFR-Free Signal Integrity (chaired by Intel) 信号完整性

New initiative 新项目

- PVC Alternative Initiative 聚氯乙烯替代材料

HFR-Free Leadership Program Project Member



i n v e n t



HUAWEI

FLEXTRONICS



FOXCONN



Elec & Eltek 依利安達

ITEQ

INNOVATION • TEAMWORK •
EXCELLENCE • QUALITY

DELPHI



Celestica™



Doosan Corporation
Electro-Materials

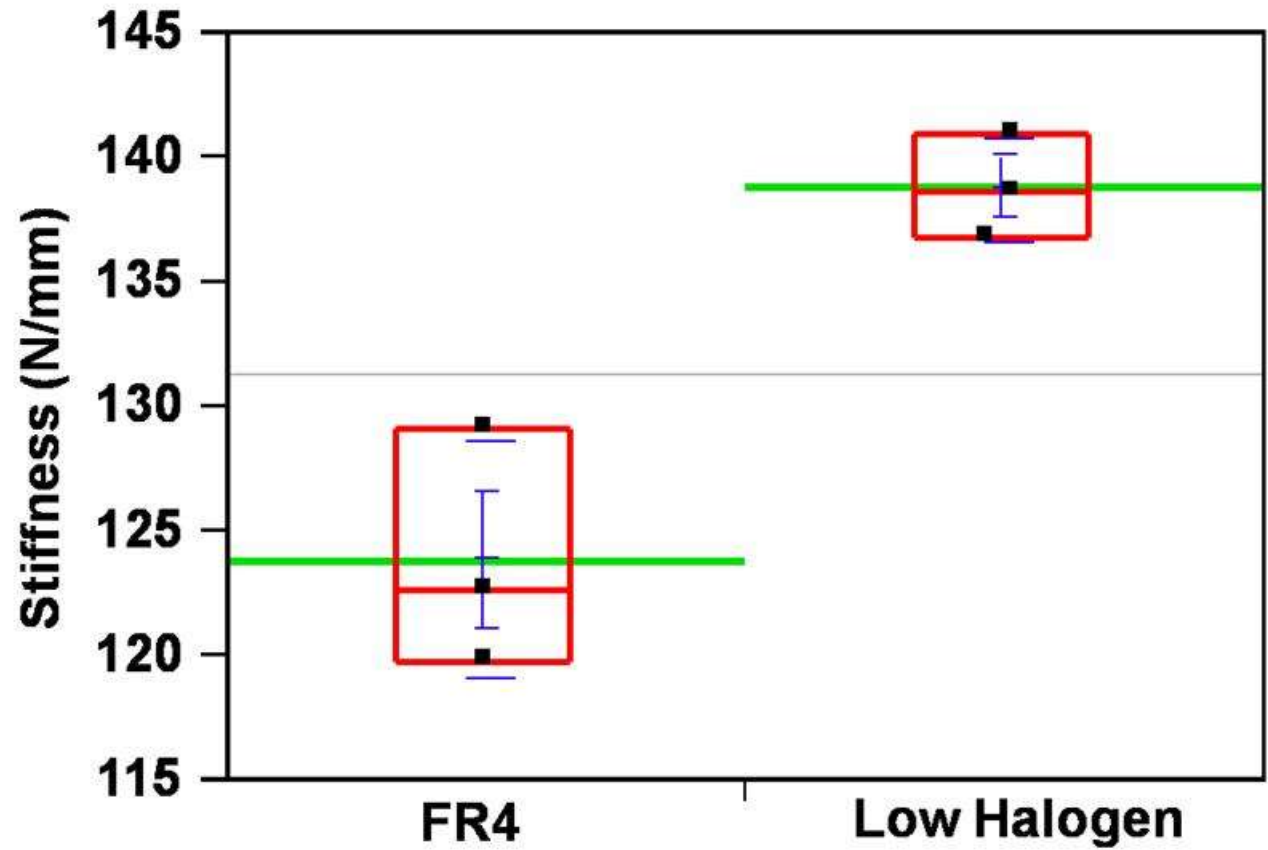


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Technical Concerns 技术问题

Solder Joint Reliability 焊接可靠性

Courtesy iNEMI HFR-Free PCB project

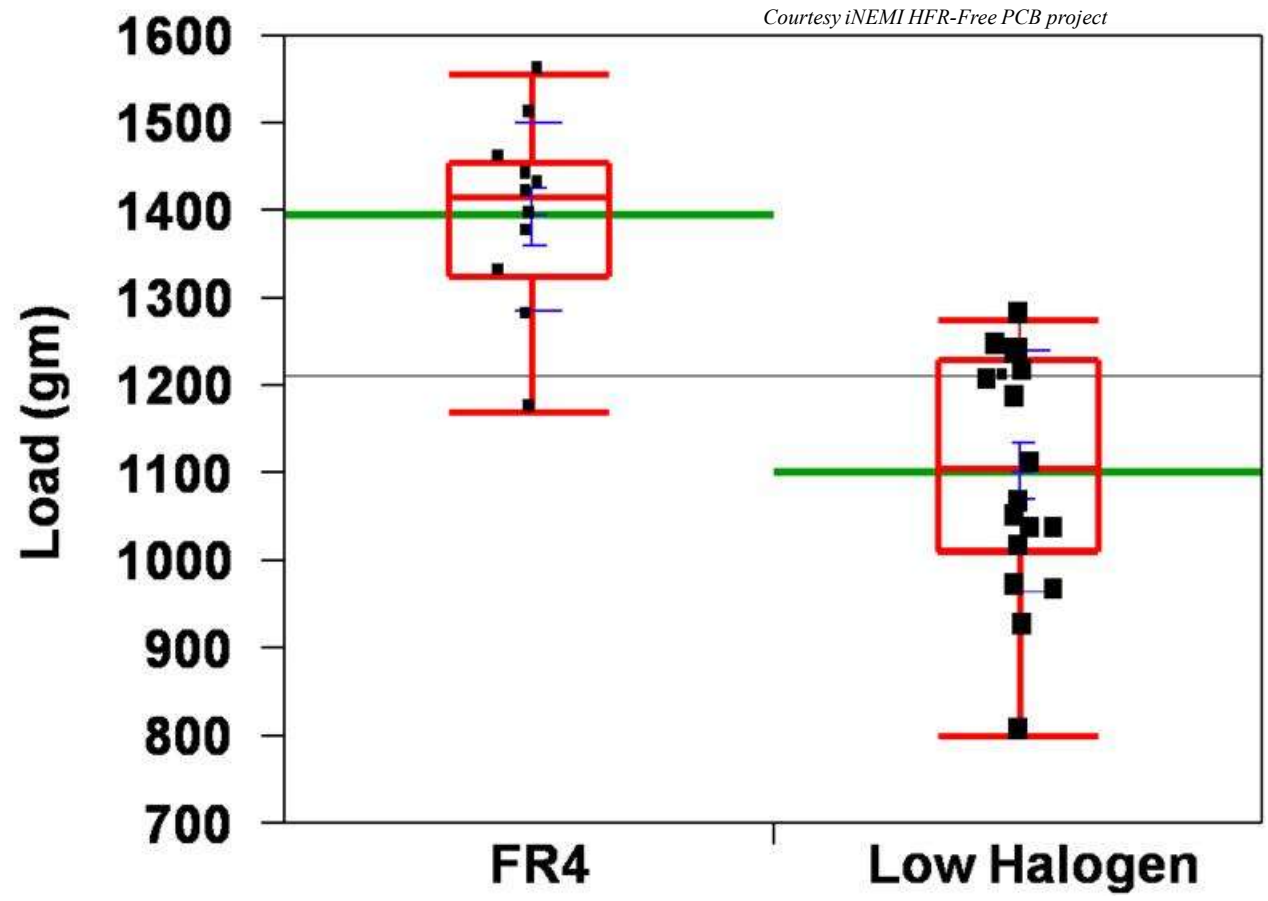


HF is ~10% stiffer
(8 layer .062" board) →

Lower mech stress limits
(higher SJR risk)



Pad Crater Performance 焊盘剥落



HF has ~20% worse cold ball pull performance



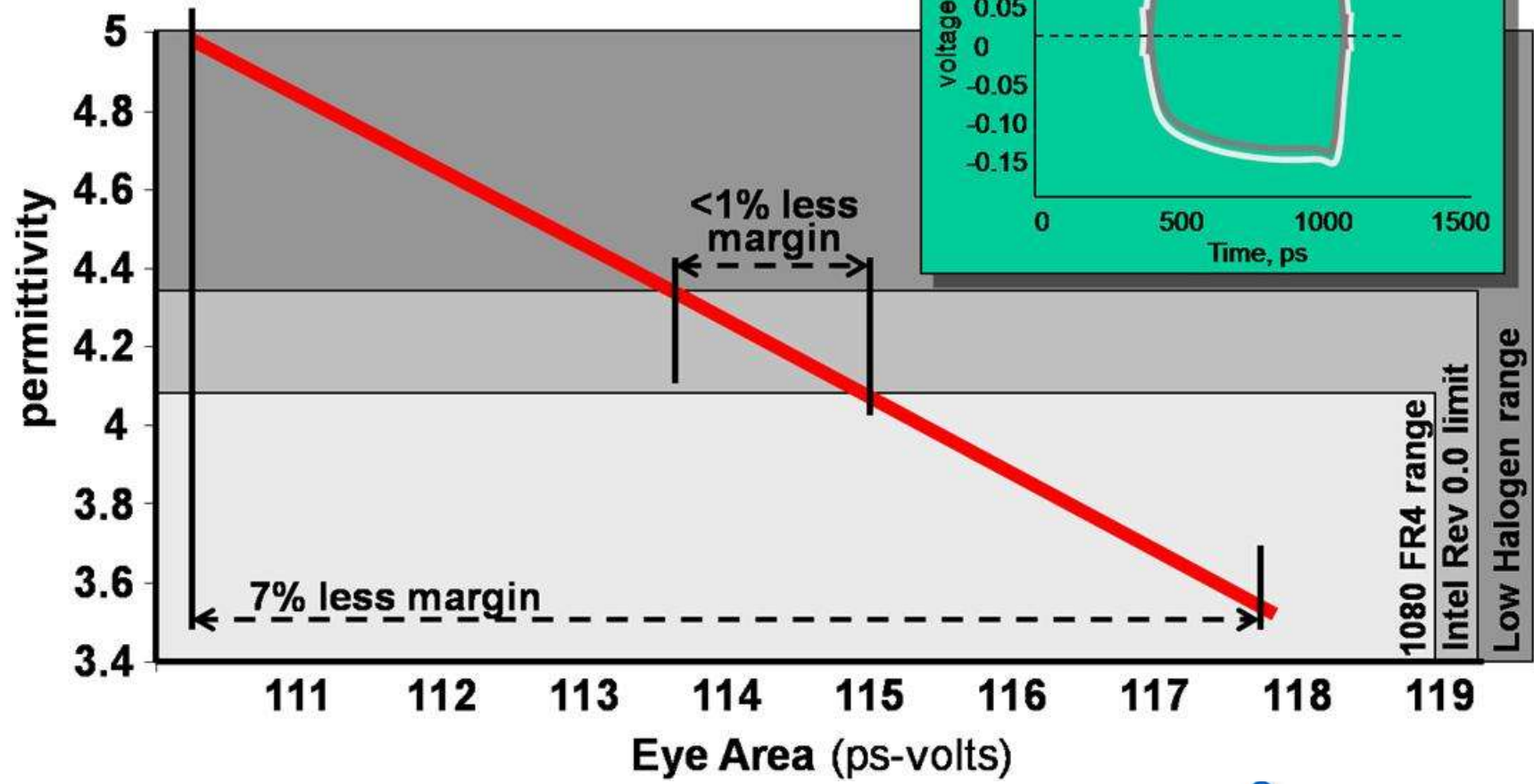
Increase pad cratering (higher rework risk)

Some parameters will have less margin!

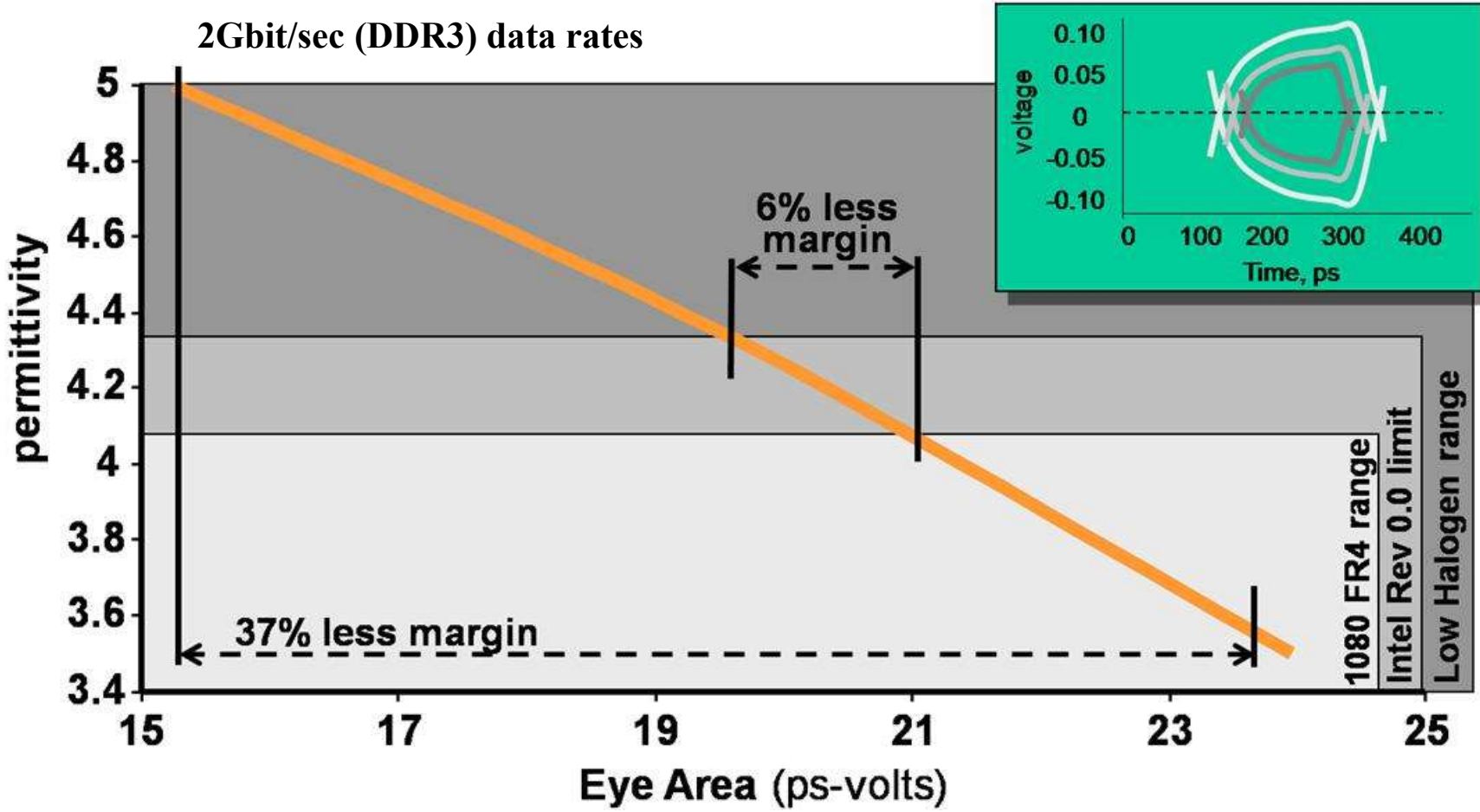


High Speed Signaling 高速信号

0.667Gbit/sec (DDR2) data rates



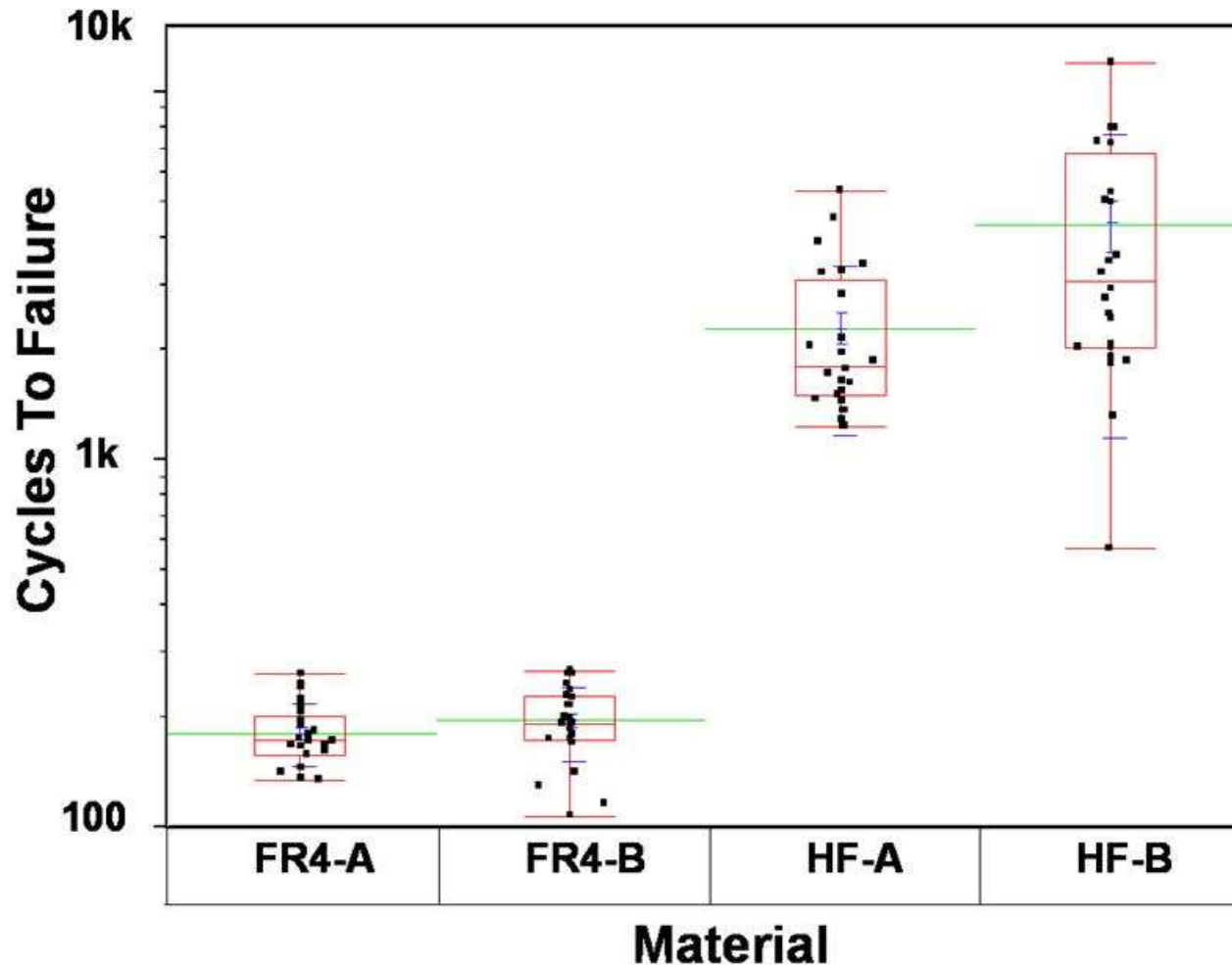
High Speed Signaling 高速信号



Emerging buses are more sensitive!



Good News: Via Reliability 好的方面: 孔的可靠性

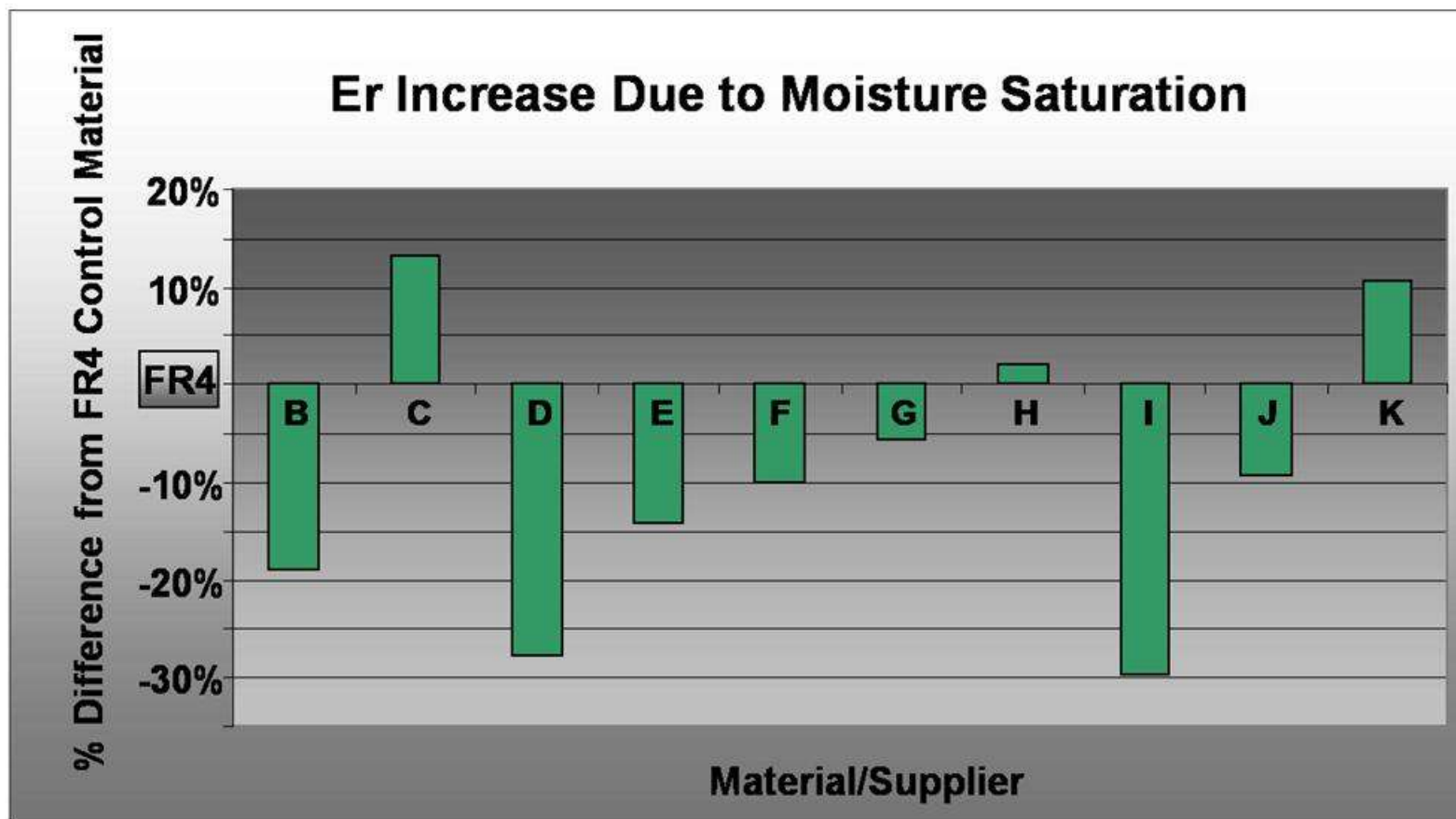


**HF materials have
10X better via
reliability**
(using IST testing)
(冷热循环互连应力测试)

- Preconditioned: 3X (260°C peak reflow temp)
- 3 minute heat up cycle
- Temp: 25°C – 150°C
- 1.5 minute cool down

Good News: Dielectric Constant Variability

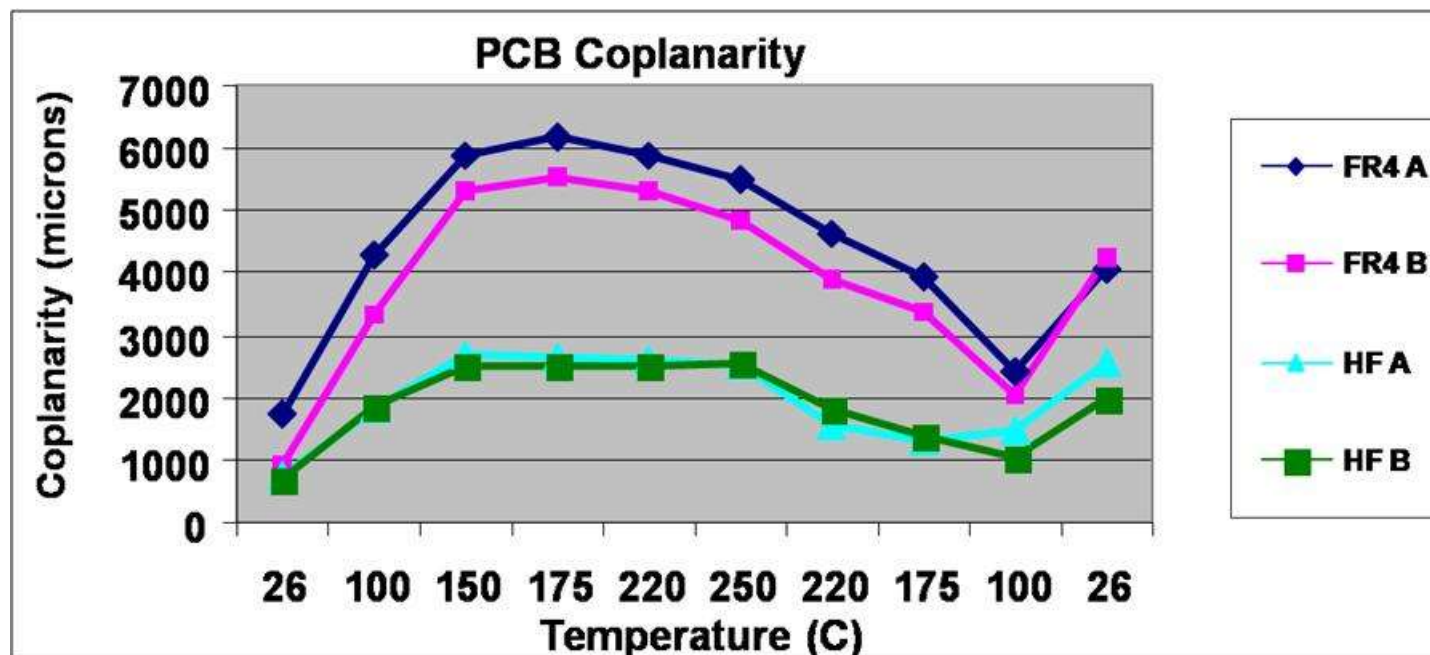
好的方面：介电常数的变化



Less Er variation due to moisture for most halogen-free laminates



Good News: Warpage 好的方面: 热变形



HF exhibits ~50% less warpage
(vs. Hi Tg FR4, 8 and 10 layer)



Sags less during reflow
(better solder joint control, reduced need for pallets)

Material Selection Summary 材料评估小结

Mat'l	Dk	Df	H ₂ O Absorb	Tg	CTE	Flex	Td	T260/Cu	T288/Cu	Peel Strength	IST	CAF	UL94 V0	Shock	Vibe	Temp Cycle	Cold Ball Pull
A	Red	Green	Yellow	Yellow	Green	Red					Green	Green	Green	Red	Red	Red	Red
B	Red	Green	Yellow	Yellow	Green	Red	Green	Green	Yellow	Green	Green	Green	Green	White	White	White	Red
C	Green	Green	Yellow	Yellow	Green	Red	Green	Green	Green	Green	Green	Green	Green	Red	White	White	Red
D	Green	Green	Yellow	Yellow	Green	Red	Green	Green	Green	Green	Green	Green	Green	White	White	White	Red
E	Green	Green	Yellow	Yellow	Green	Red	Green	Green	Yellow	Yellow	Green	Green	Green	White	White	White	Red
F	Red	Green	Yellow	Yellow	Green	Red	Green	Green	Yellow	Green	Green	Green	Green	White	White	White	Red
G	Yellow	Green	Yellow	Yellow	Green	Red	Green	Green	Yellow	Green	Green	Green	Green	Red	Red	Red	Red
H	Yellow	Green	Yellow	Yellow	Green	Red	Green	Green	Yellow	Yellow	Green	Green	Green	White	White	White	Red
I	Yellow	Green	Yellow	Yellow	Green	Red	Green	Green	Green	Green	Green	Green	Green	White	White	White	Red
J	Yellow	Green	Yellow	Yellow	Green	Red	Green	Green	Yellow	Green	Green	Green	Green	White	White	White	Red
K	Green	Green	Yellow	Yellow	Green	Red	Green	Green	Green	Green	Green	Green	Green	White	White	White	Red

Color Code

- Green: Equal to or better than FR4 (No issue)
- Yellow: Marginal vs FR4 (Issue not clear)
- Red: Worse than FR4 (Clear Issue)
- White: No Data

Derived from iNEMI WG data

Material selection can matter!



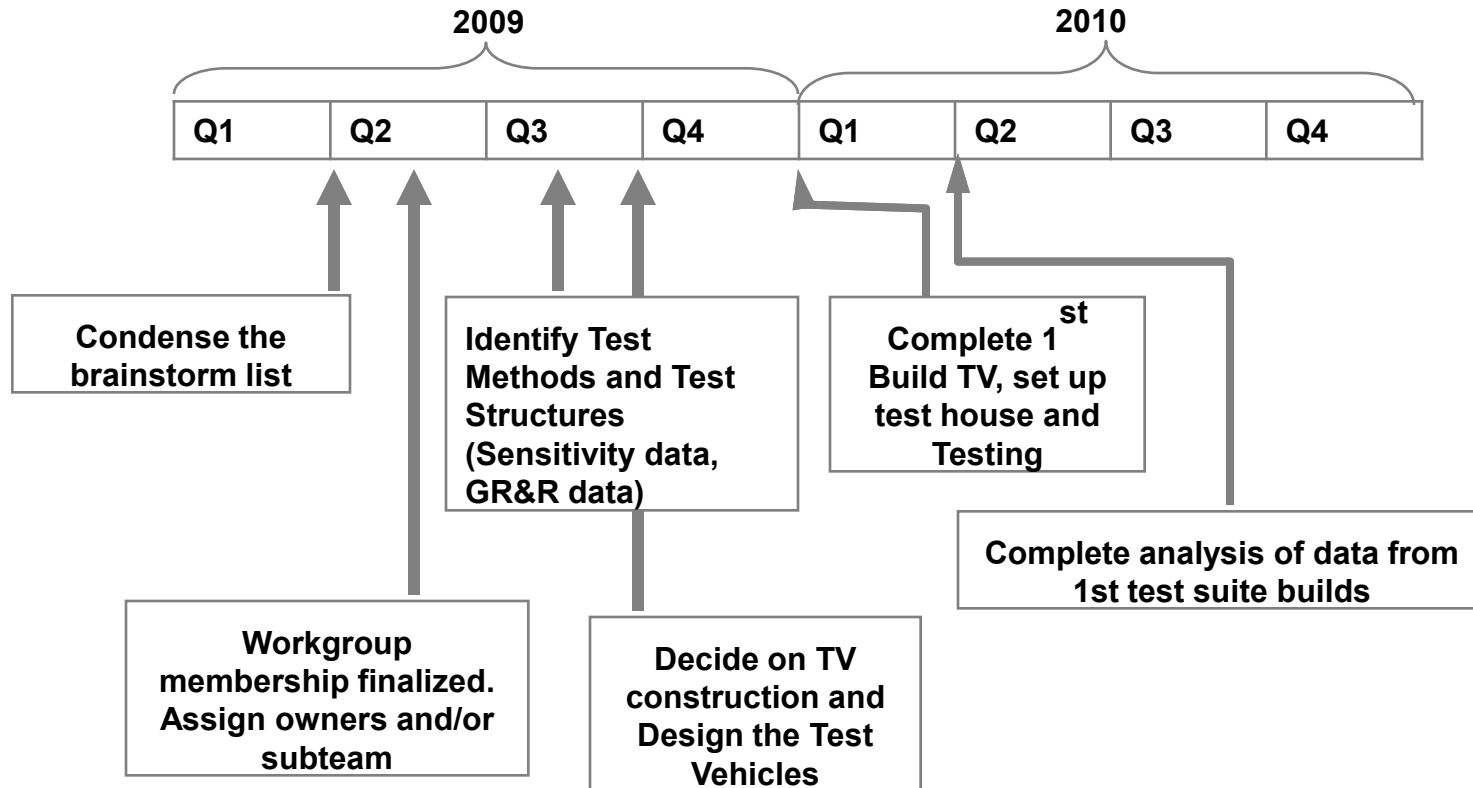
iNEMI HFR-Free Leadership Program

Consortium Objectives 联盟目标

- 1. Identify technology readiness, supply chain capability, and reliability characteristics for “HFR-free” alternatives to conventional printed circuit board materials and assemblies** 查看技术是否就绪，产业链的供应能力以及无溴化阻燃剂替代品在常规PCB材料和装配中的可靠性能
 - **Spans electrical and mechanical properties** 包括电和机械属性
 - **Includes assessing if board/system design modifications can overcome material property limitations** 评估板/系统设计的修改是否能弥补材料属性的限制
- 2. Define technology limits for HFR-free materials across all market segments** 定义各产品门类对无BFR材料的技术性能的限制要求
 - **Initial focus is on client platforms (desktop, notebook)**
 - **Goal is to drive laminate supplier slash sheet content**



Timeline 时间表



Emerging buses are more sensitive!

Timeline 2011-2012



Closing Thoughts结束语

- **Conversion to Pb-Free Solders has demonstrated 向无铅焊接转移表明:**
 - **The need to select and develop the technology and verify its reliability 需**
要选择并开发相关技术并验证其可靠性
 - **The need for the entire supply chain to be involved 整个产业链的参与**
 - Segments driving the change 按市场门类驱动相应的转换
 - Segments that may be impacted by the change 由于转移对不同产品门类也有影响
 - **The need to develop a conversion time line for each class of products 需要**
针对不同类型的产品制定转换时间表
- **The Voluntary adoption of HFR-Free Technology will require 自愿采用**
无卤技术将需要:
 - **All of the above 以上所有**
 - **Verifying the design and electrical performance 验证设计和电性能**
 - **Each Class of Products working with its supply chain to insure successful**
planning and execution of the conversion 每个产品部门和其产业链一道协作
来确保转移计划和执行的成功





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