The Institute of Circuit Technology Evening Seminar

Tuesday, 5th June 2007

Laminate: Just a substrate ?

Introduction

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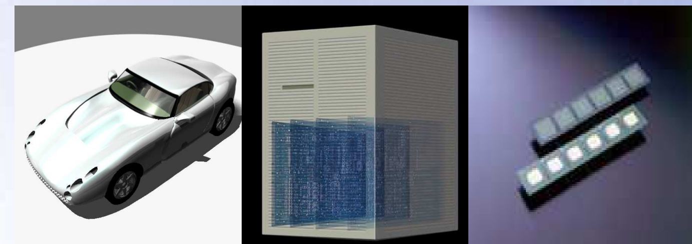
Applications of electronic systems are spread amongst many different fields and invading our modern life.
Requirements in terms of their performance are varied depending on the environment and scope of their use.

Consumer goods are required to work for the relatively short time of their life.

But whenever we move to more sophisticated applications, where importance of the service is paramount, requirements are increasing:
original performance and consistent results are compulsory.



Introduction

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All that means **RELIABILITY!**

Once we consider the components, and among them laminates, an additional request is on the table: **PROCESSABILITY!**

This is the scenario we have to face today, especially after the application of lead-free soldering has been reality since July 2006.

Lead free - Alloys

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Alloy	Melting point (℃) (eutectic T)
63 Sn – 37 Pb	183
100 Sn	232
Sn – 4 Cu – 0,5 Ag	216
Sn – 3,5 Ag	221
SN – 0,7 Cu – Ni	227

Tg – measurement methods

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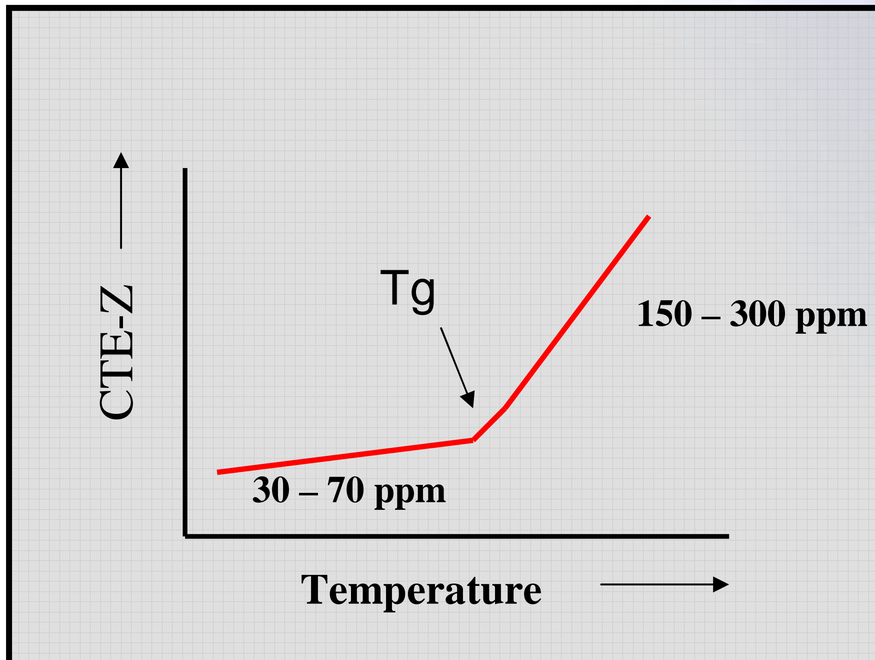
Tg method	Meaning
DSC = Differential Scanning Calorimeter	Measuring the heat capacity of a sample over temperature increase and comparing to a reference
TMA = Thermal Mechanical Analyses	Measuring the z-axis expansion of a sample over the temperature increase
DMA = Dynamic Mechanical Analyses	Measuring the stiffness of a oscillating sample over the temperature increase

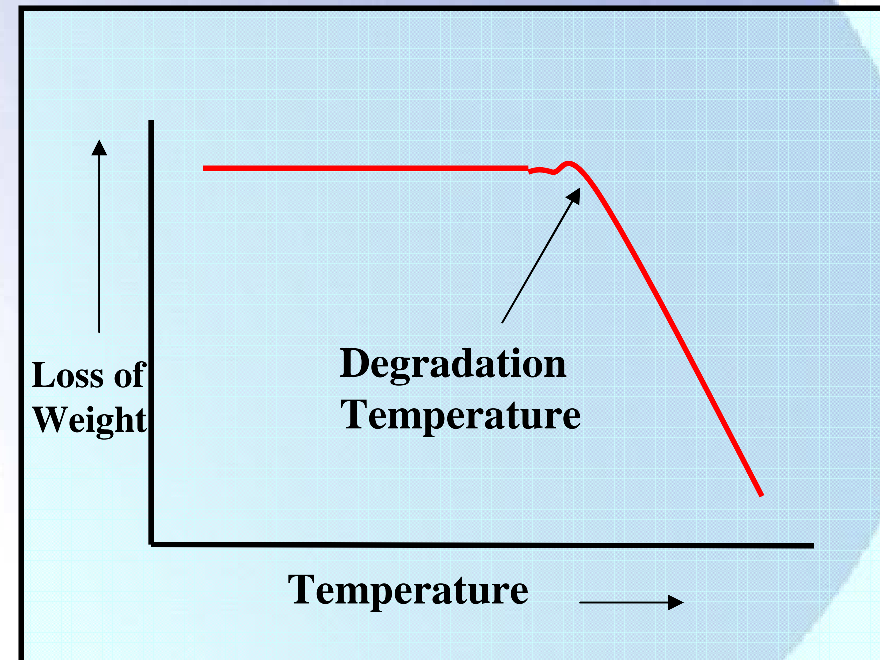
CTE (z) and Degradation temperature

Coefficient of thermal expansion-Z



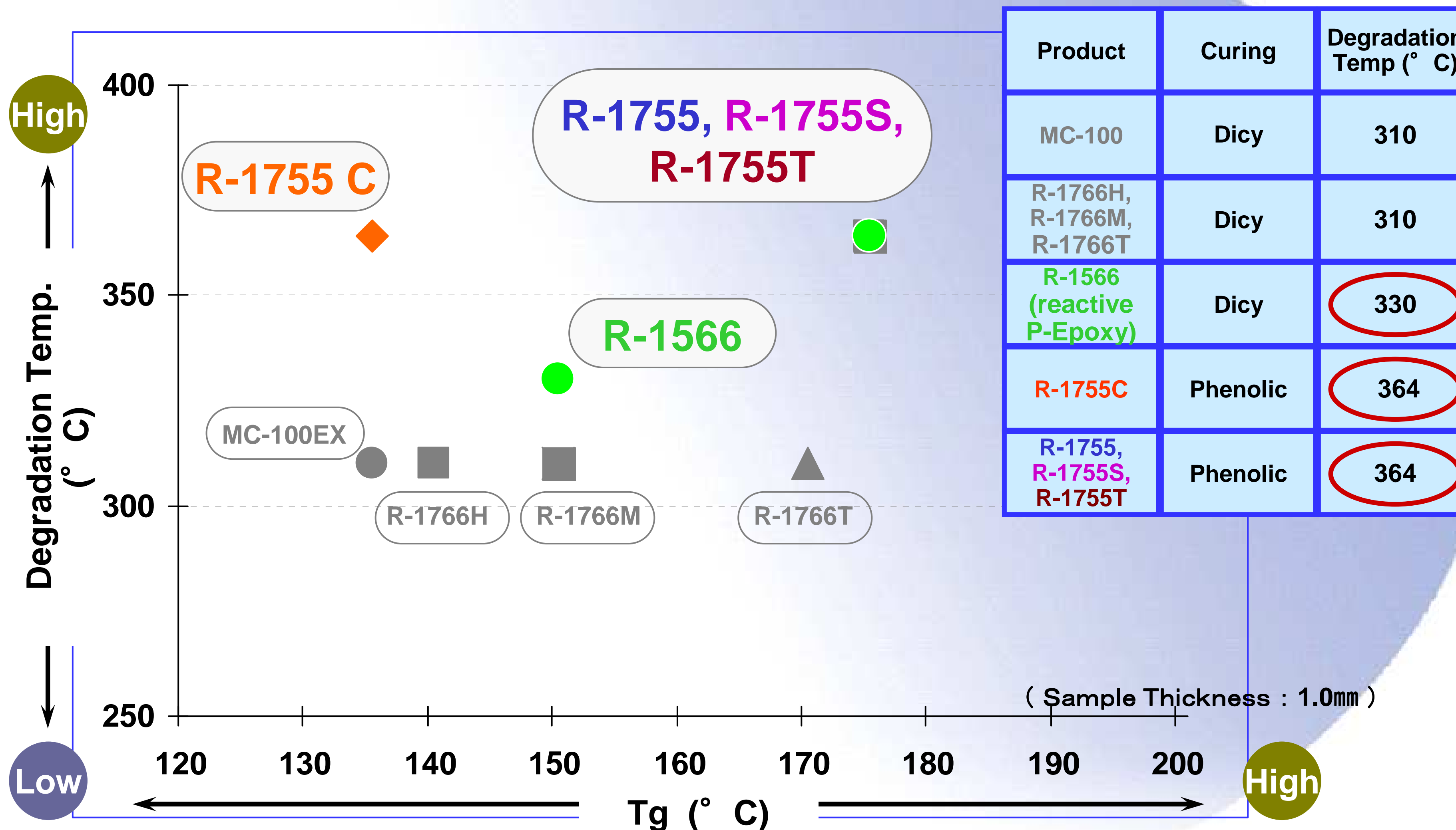
measured by TMA

Degradation Temperature



measured by TGA

Degradation temperature



Product	Curing	Degradation Temp (° C)
MC-100	Dicy	310
R-1766H, R-1766M, R-1766T	Dicy	310
R-1566 (reactive P-Epoxy)	Dicy	330
R-1755C	Phenolic	364
R-1755, R-1755S, R-1755T	Phenolic	364

The above data are our actual values and not assured values.

CTE (z) versus Tg

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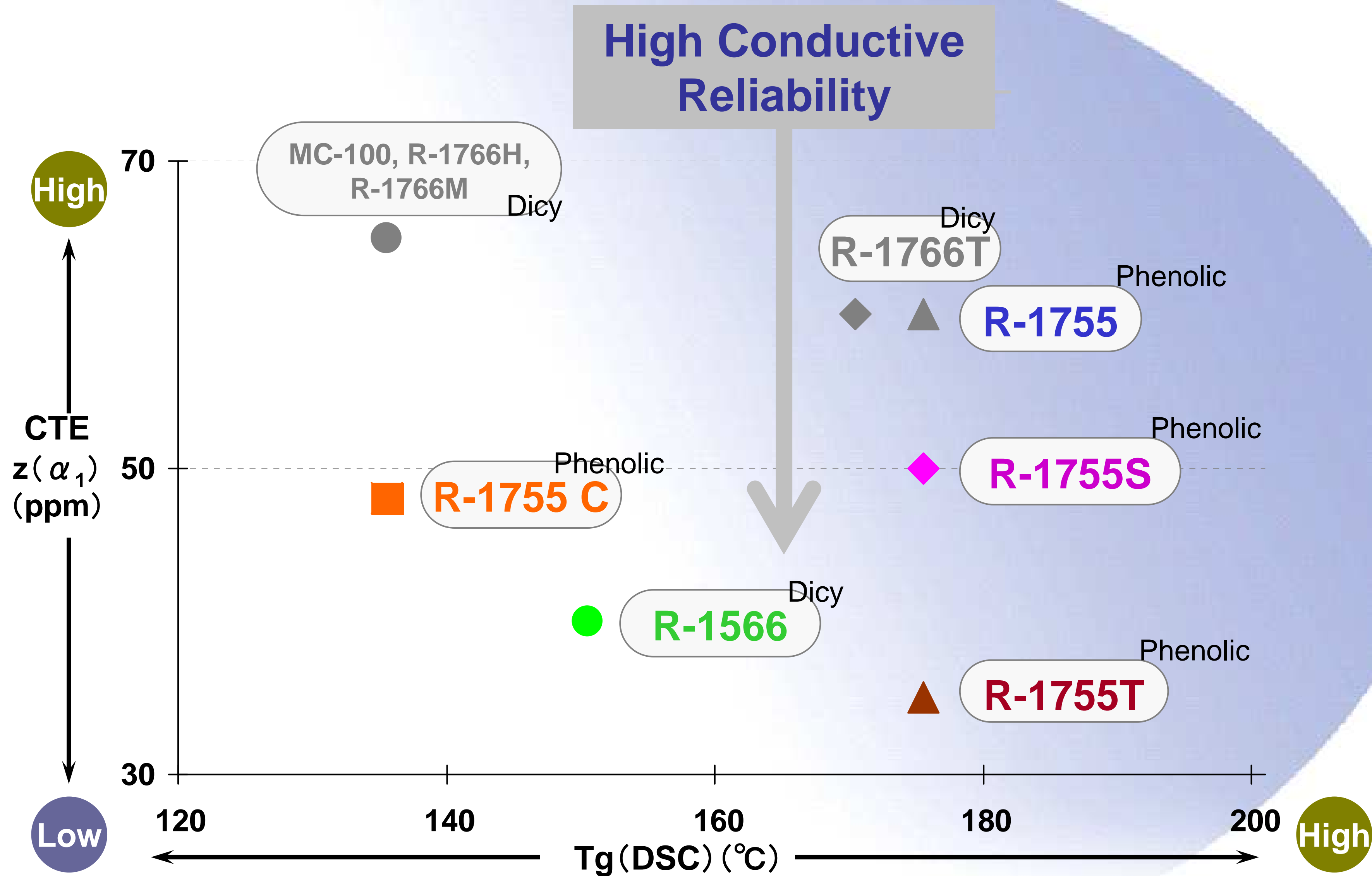

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Temperature cycle requirements

Location of the electronic equipment	Ambient Temp. (℃)
Passenger compartment	- 40 to + 85
Under the hood	- 40 to + 105
On engine / on transmission	- 40 to + 125
Inside transmission / fuel injection pump	- 40 to + 140

Through hole reliability - 1

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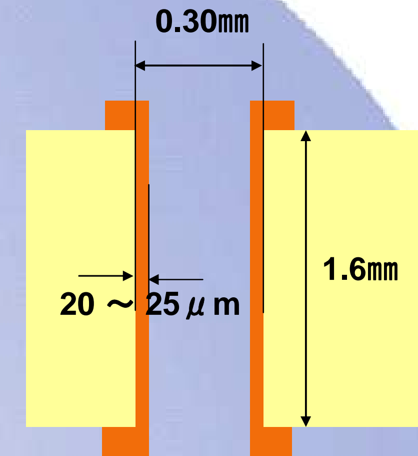
■ Result

Cycle	-65℃ (30min)⇔125℃ (30min)

The above data are our actual values and not assured values.

■ Test Sample



Throwing power
(Uniformity of plating thickness)
:80% or more

Through hole reliability - 2

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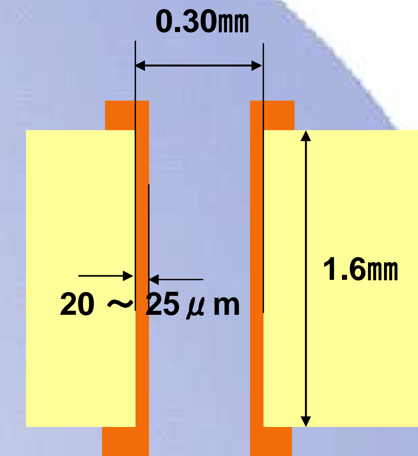
■ Result

Cycle	-40℃ (15min)⇔150℃ (15min)

The above data are our actual values and not assured values.

■ Test Sample



Throwing power
(Uniformity of plating thickness)
: 80% or more

Heat resistance

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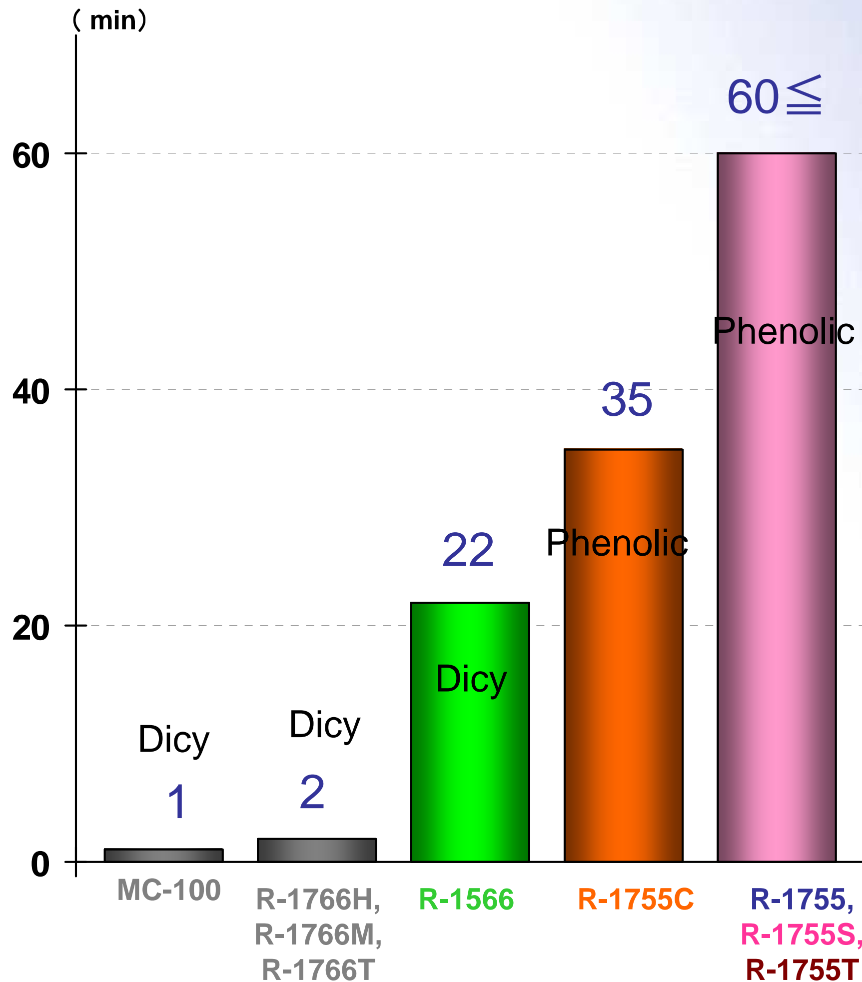
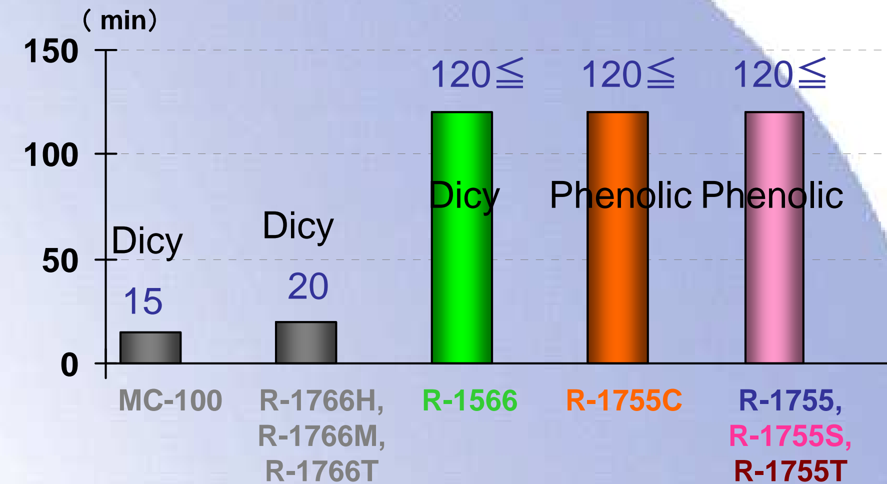
■ T-288 (IPC-TM-650)



■ T-260 (IPC-TM-650)



(Sample thickness：1.0 ㎜)

The above data are our actual values and not assured values.

CAF – resistance (Conductive Anodic Filament)

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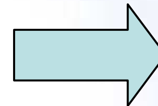
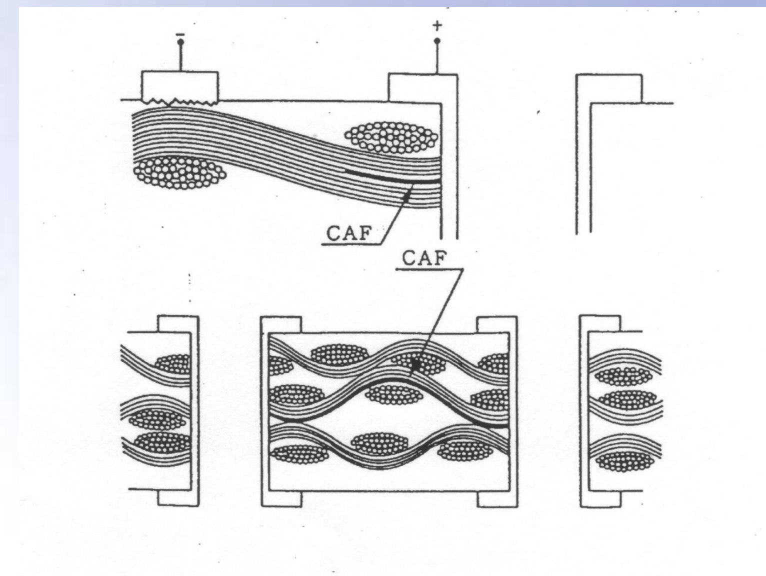
Need for CAF – resistance

- Higher integration of components
- High density PWB-designs (HDI)
- Shorter distances of PTH / track
- Environmental conditions
- Longer life time of devices

Most common CAF-failures



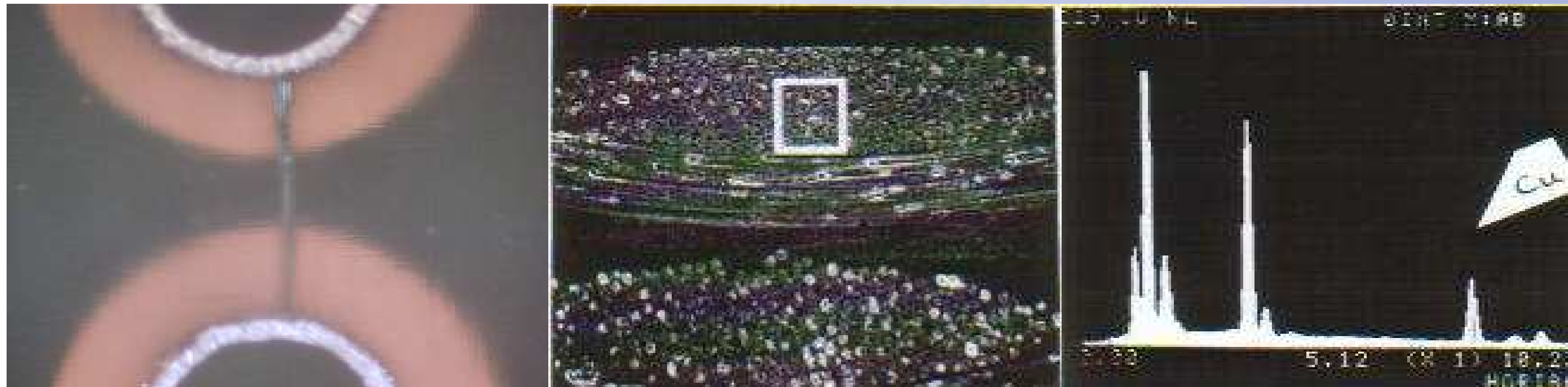


- hole to hole
- hole to track
- track to track

CAF – resistance (Conductive Anodic Filament)

CAF mechanism

Electrochemical reaction between copper anode and cathode is forming copper filaments (Electromigration)



Reason

- Poor bonding between resin/glass filaments (Silan Finish)
- Ionic contamination
- Moisture absorption
- PCB-Process (Drilling parameter, Through hole plating conditions, etc.)

CAF – resistance (Conductive Anodic Filament)

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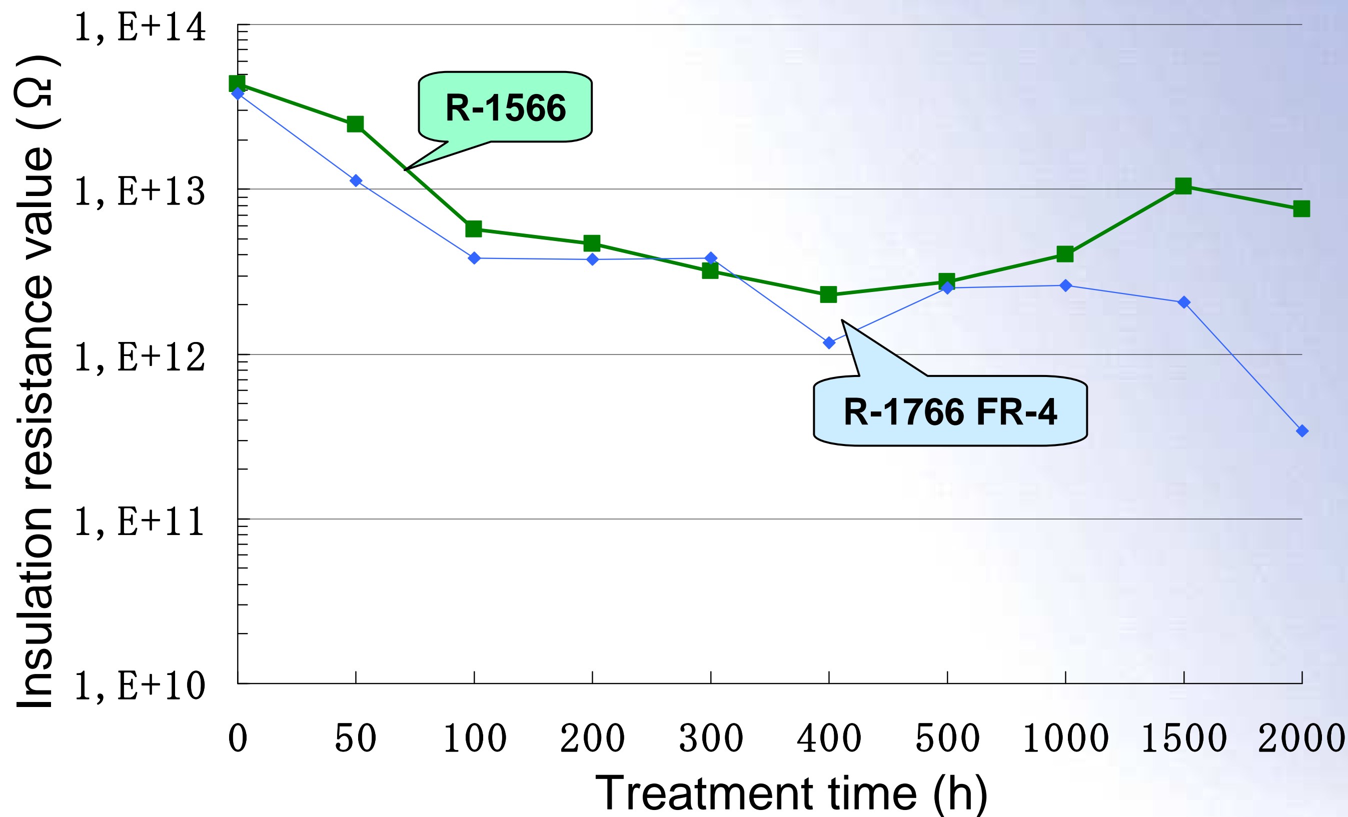
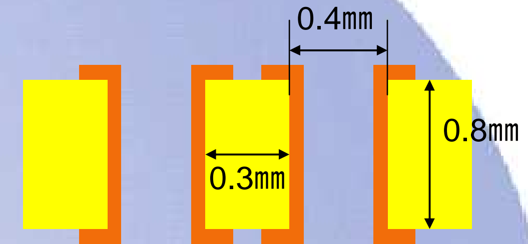
Achievement of 2000 hours with the application of 50V DC at 85°C and the relative humidity of 85%

■Evaluation result



■Evaluation sample



Distance between
Hole walls : 0.3 ㎜
Hole diameter : 0.4 ㎜
Board thickness: 0.8 ㎜

■Treatment condition

Applies 50 V DC at 85℃ and the relative humidity of 85%.

The above data are our actual values and not assured values.

CAF – resistance (Conductive Anodic Filament)

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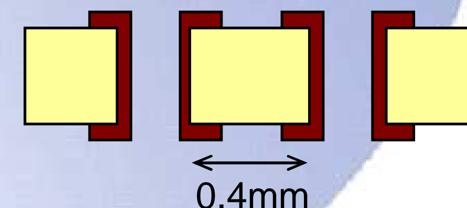
■ Result

The above data are our actual values and not assured values.

■ Test Condition

120℃ 85%RH DC50V

■ Test Sample



Sample thickness 0.8mm
Through-hole diameter 0.25mm

Additional requests

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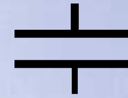
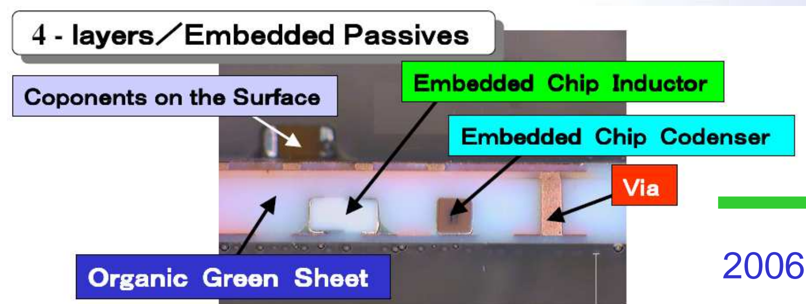
- **Laminate for Buried capacitors**



ZBC 2000

on market

- **Material for embedded components**

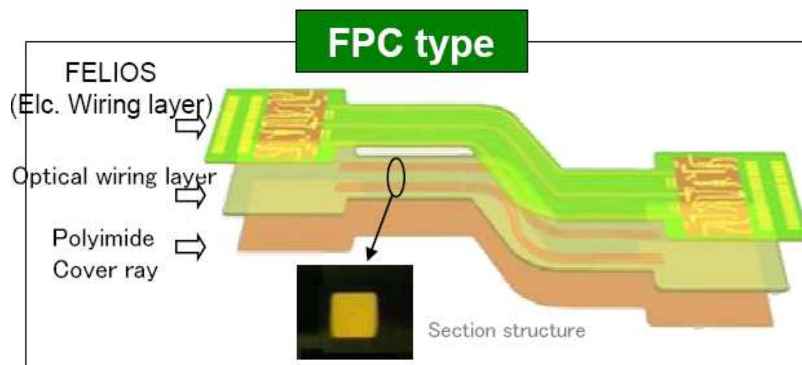


under development (Sampling)

2006

Mid 2008

- **Optoelectronic material**



To realize materials for laminate-processable High Performance Optical wiring, we are working at the optical wiring board.

Many thanks for your interest

Contact:

Manfred Walchshofer
Tel.: + 43-7223-883-174
E-mail: manfred.walchshofer@mce.co.at