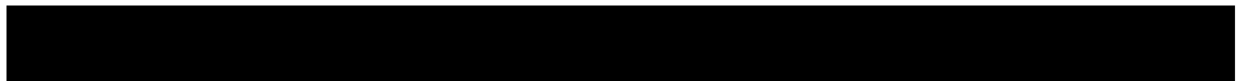
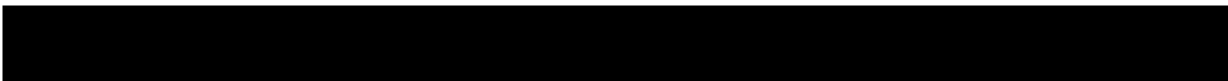
Speed Matters
Ormet Z Axis Paste and Zeta® Lock



Making z-axis connections

CURRENT PRACTICE



Comparison of Techniques

Sequential

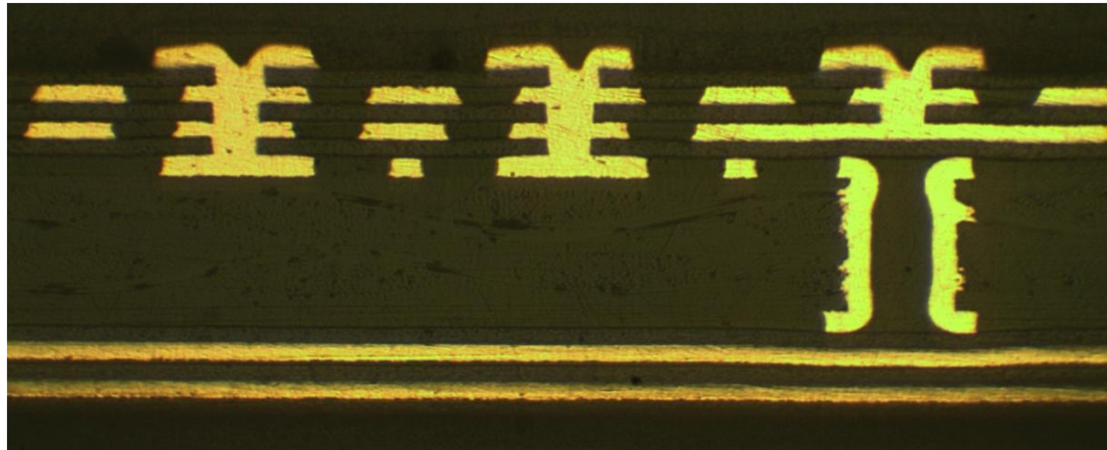
- Unrestricted Via placement.
- Very thin layers do not require handling.
- Each build-up layer can be very thin.
  - Ease of drilling, plating

Parallel

- Limits via placement
- Buried vias in double sided cores
- Fast
  - Fewer process steps
  - Reduced process time
  - Less scrap risk

Sequential Build-Up

- As build-up layers are added, blind vias can be placed anywhere needed.
- Core maybe double sided or multilayer.
- Many combinations are possible.



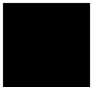
"Any Layer" HDI

- Plated through holes, through vias, blind vias all connect copper foil layers in the z-axis.

- Unrestricted Via placement = "Any Layer"
  - Electrically discrete Vias anywhere on any layer.

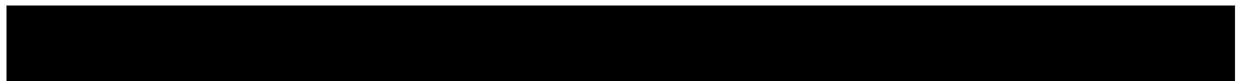
Sequential processing (Build-Up)

- X-N-X
  - X = build-up layer
  - N = Core
- 4-2-4
  - Double sided core (plated core)
  - 4 build-up layers on each side
  - 5 trips through lam, desmear, electroless Cu and electrolytic Cu
- 3-6-3 = 4 trips if core is plated
- 5-4-5 = 6 trips if core is plated



Making the z-axis connections during lamination

PASTE INSTEAD OF PLATING



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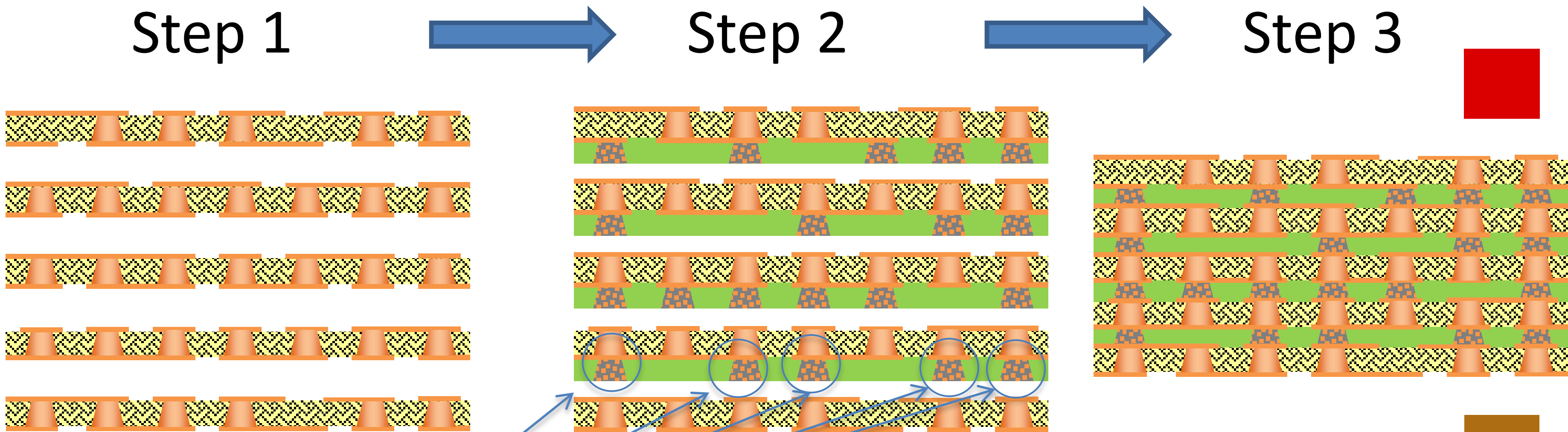
"Any Layer" HDI using Paste



Z-axis conductors applied prior to lamination.

Paste interconnects used to connect 2-layer cores in a single process step

Why is Ormet Paste Different?

- Transient Liquid Phase Sintering (TLPS) - Compositions comprising powder metallurgy (90% by weight) mixed in particulate form.
  - A low melting point alloy combined with high melting point metal
- During thermal processing:
  - The alloy becomes molten and reacts with the metal to form new alloy compositions and/or intermetallic compounds
  - This reaction continues until one of the reactants is fully depleted
  - **The reaction starts at 150°C (normal lamination temperatures)**
  - This is unlike most silver pastes which are held together by the polymer
- This also forms a metallurgical bond with metals it comes in contact with.

Ormet does not cure, it sinters into a metal mass

Ormet after sintering

After sintering, Ormet does not remelt even at assembly temperatures

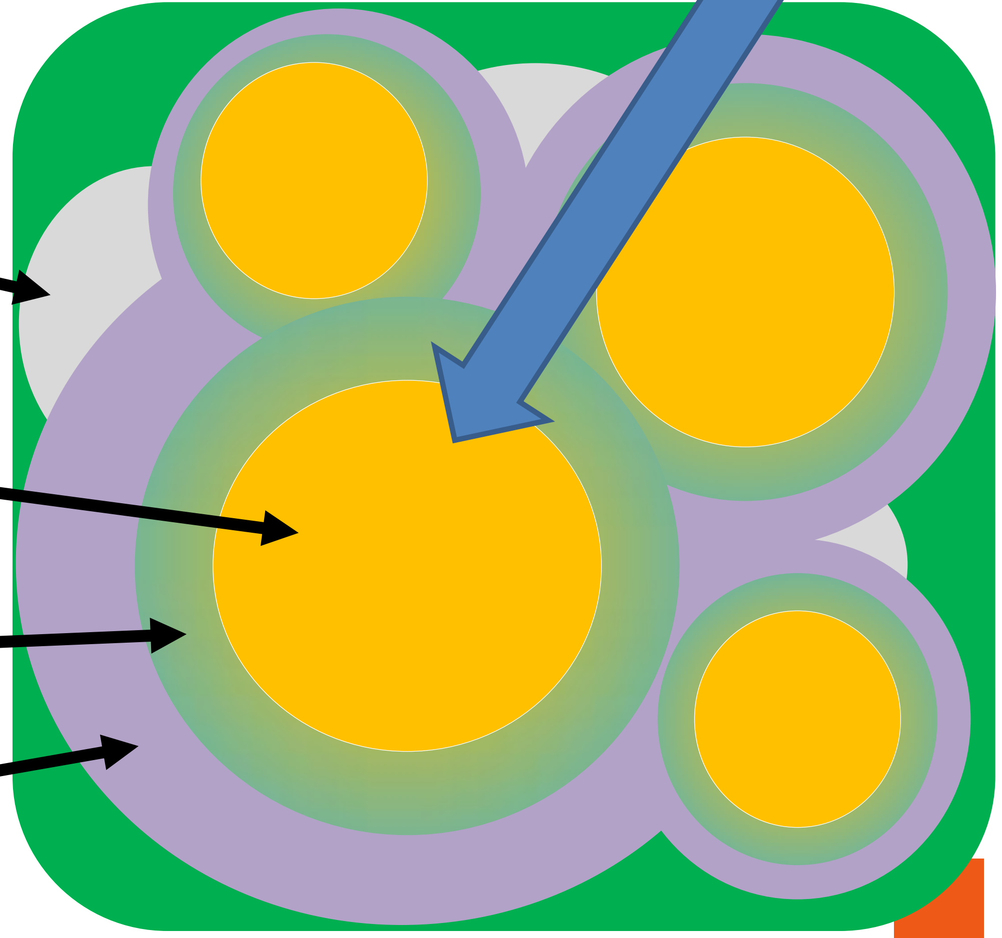
Direction of tin migration

Bismuth
Melt 267° C
10-16% of total matrix

Copper
Melt 1085° C

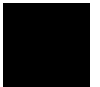
Cu_3Sn intermetallic
Melt 640° C

Cu_6Sn_5 intermetallic
Melt 415° C



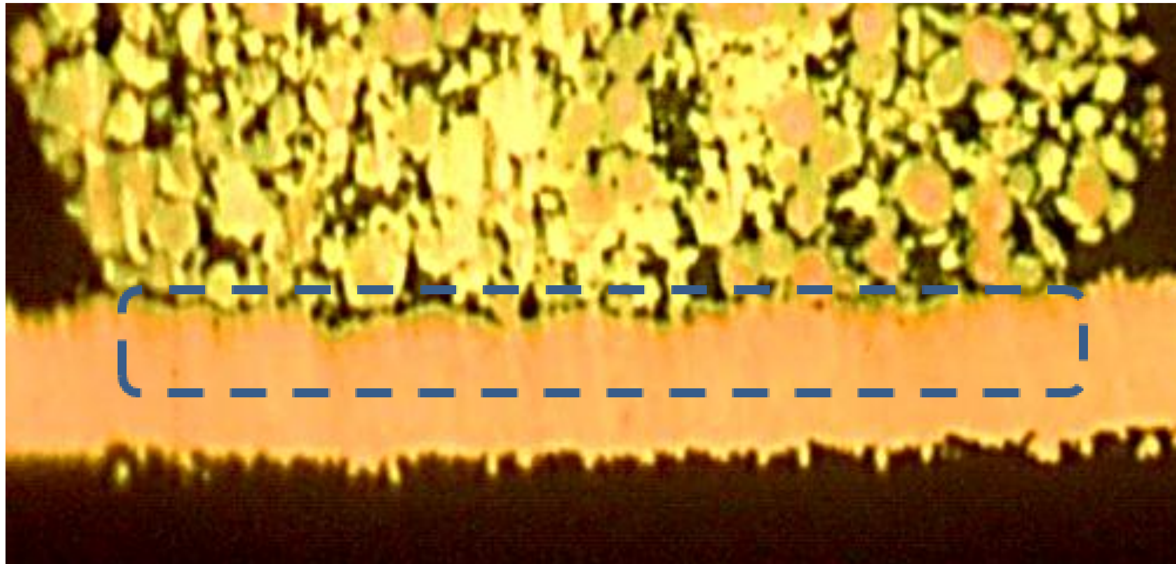
Sintering

Sped Up Sintering.mov



Metallurgical Bond to Copper Layers

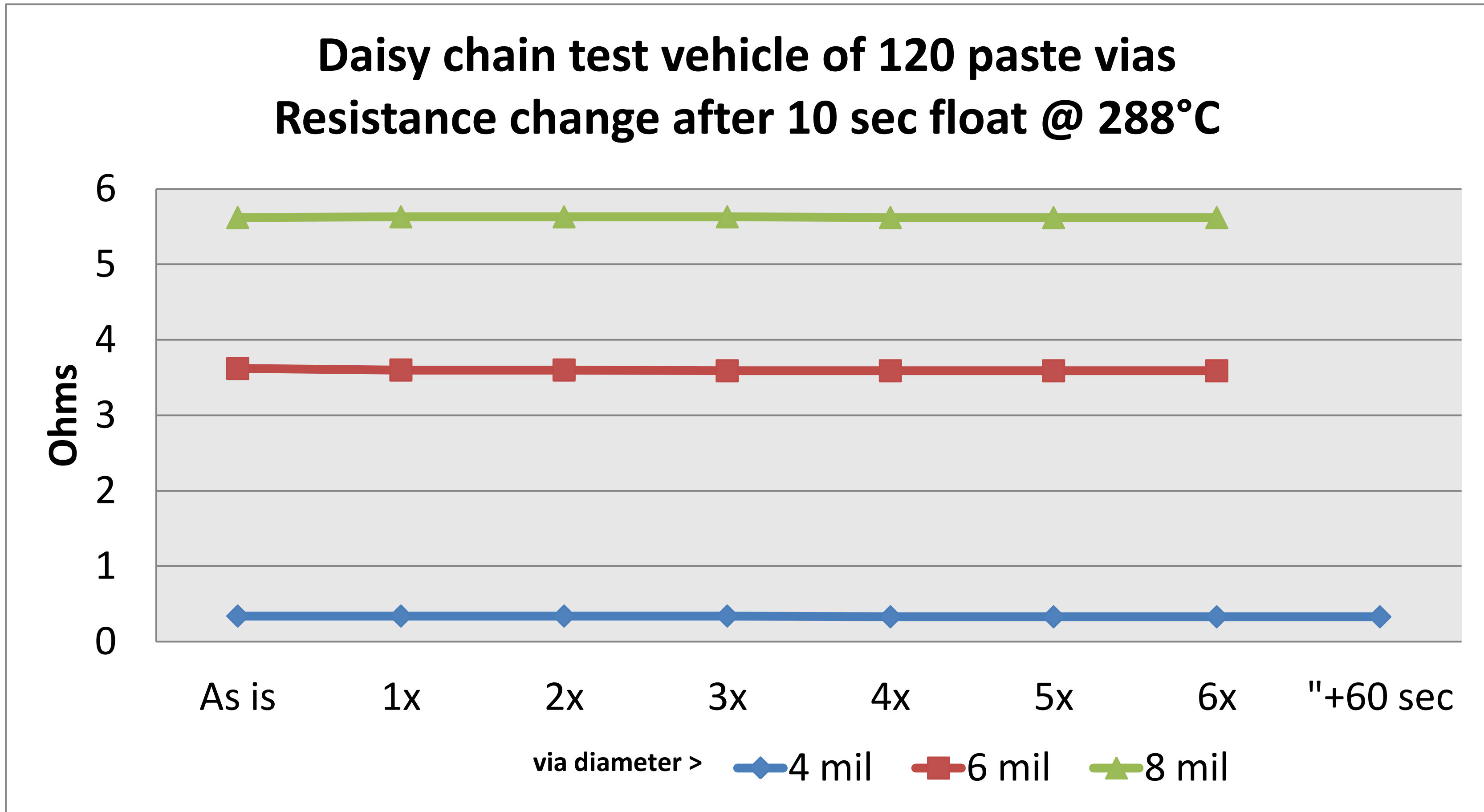
- During sintering alloying also occurs with copper innerlayer.



Comparison of Z-axis Paste Processes

Process	Paste Type	Paste Cure Before lamination	Bonding Dielectric	Metallurgical Bond
Ormet	TPLS Alloy	No	Many	Yes
ALIVH	Copper	No	Non-woven B-stage	No
B2it	Silver	Yes	RCC	No
Copper Pillar	Copper	N/A	Liquid or RCC	No

TLPS Paste = Thermally Stable Structure



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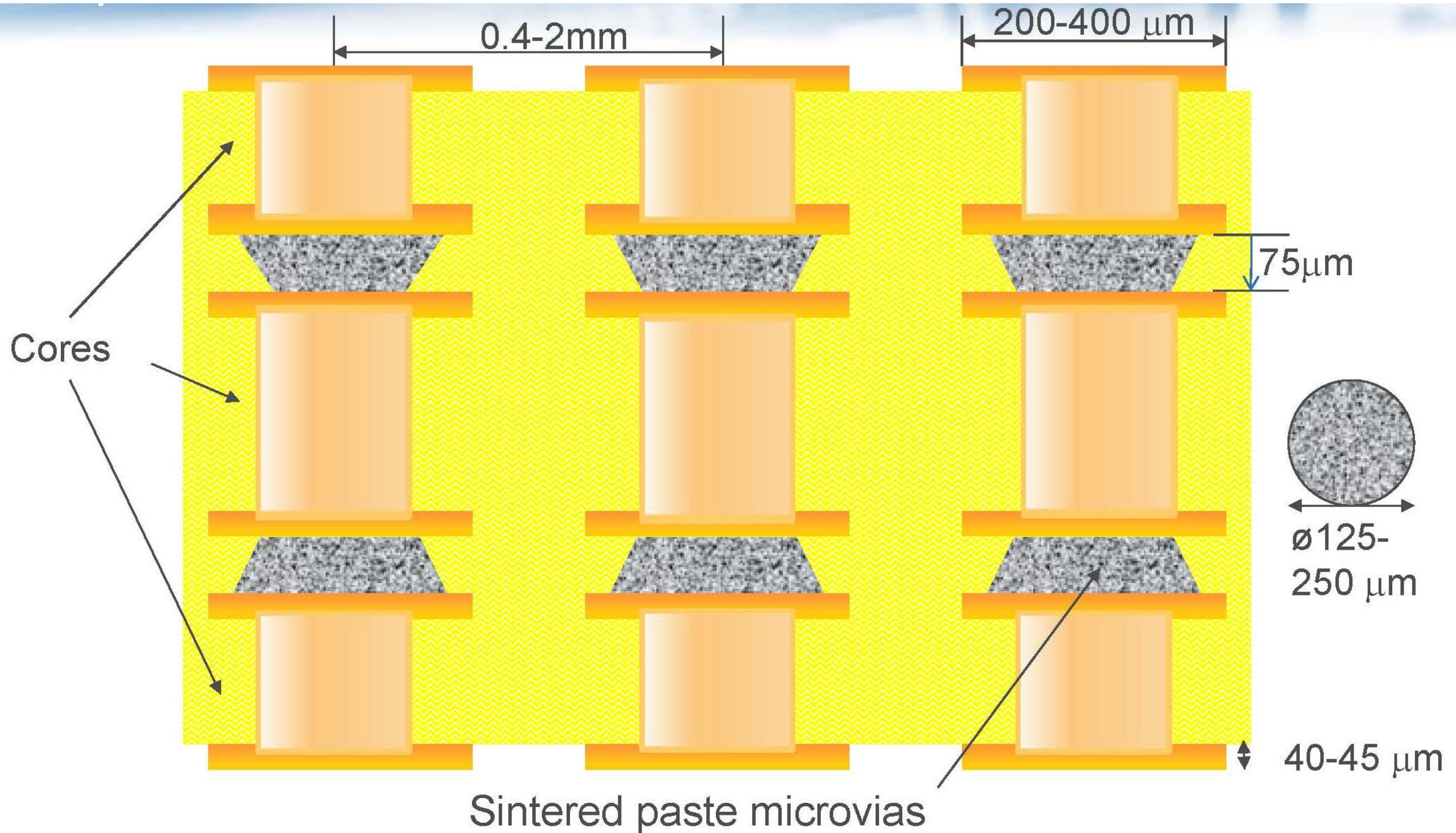
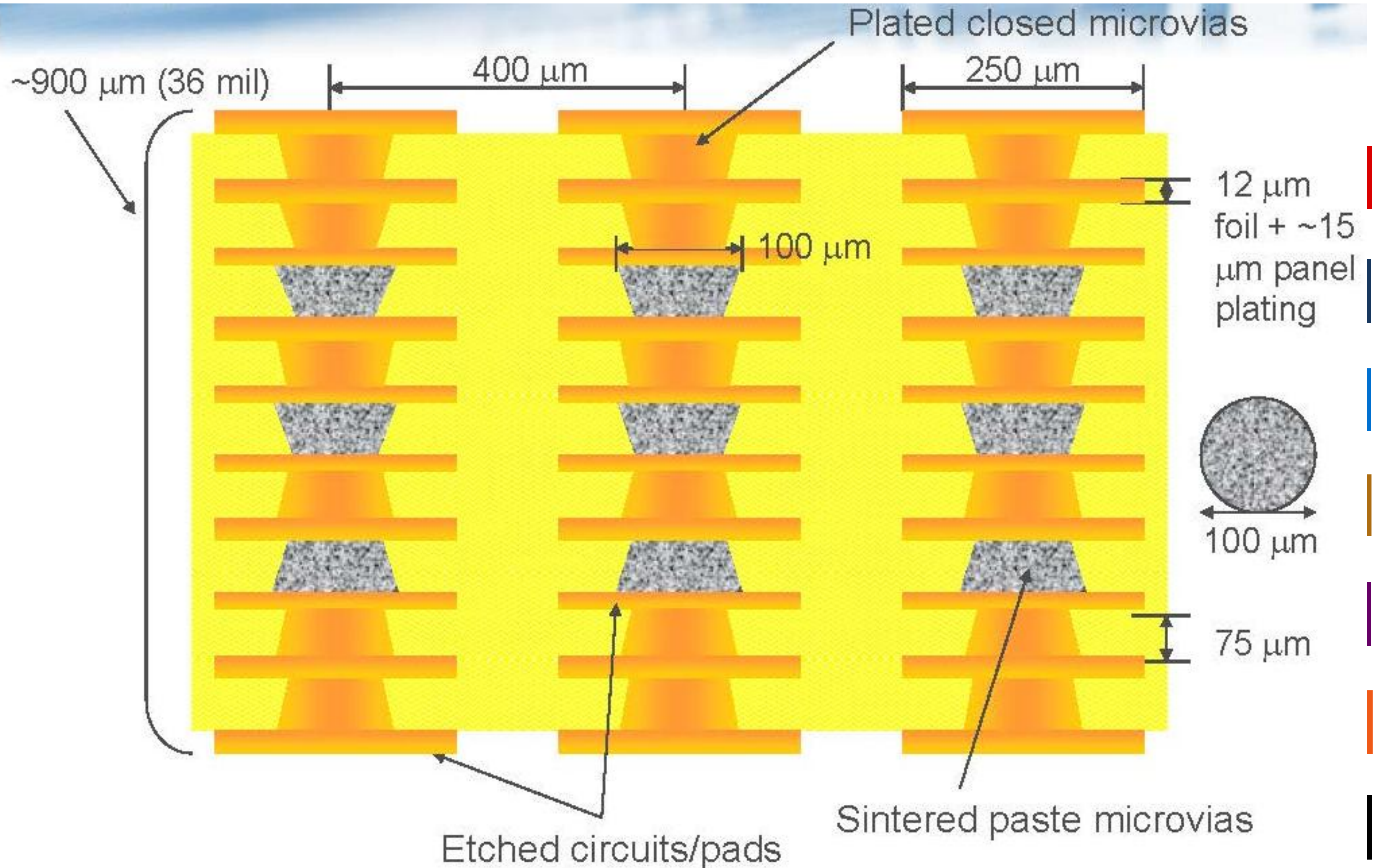
Core to Core

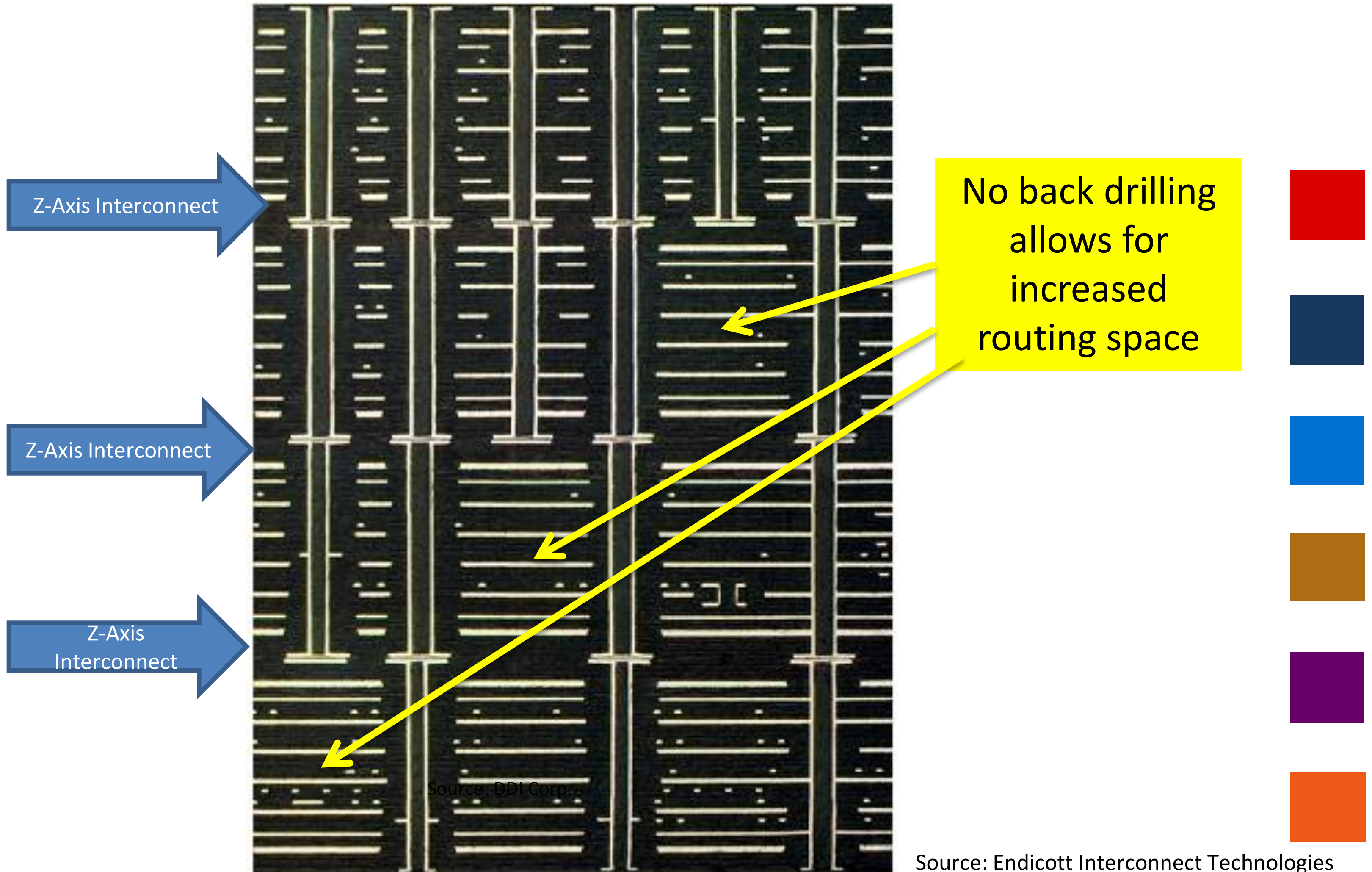


Mixed Blind and Paste vias



32 Layer (2 x 16)

Benefits of Paste Interconnect (72 layer, 4 x 18)



Source: Endicott Interconnect Technologies

Ormet Z Axis Interconnects Improve Throughput and Reduces Process Cost

	Key Process Steps				Minimum
	PTH	Microvia	Lam.	Paste Layers	Cycle Time
3-4-3 Plating	2	4	4	0	107 hrs
Process #1	5	0	1	4	37 hrs
Process #2	0	0	6	8	53 hrs
Process #3	0	0	1	9	28 hrs
Total Process Steps	Seq Lam = >240 steps		Process 3 above = <50 steps		

- Very strong drivers to paste processes
  - Cost
  - Higher Yields
  - **Speed**
  - Circuit Density
  - Lower Capital Investment

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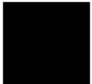
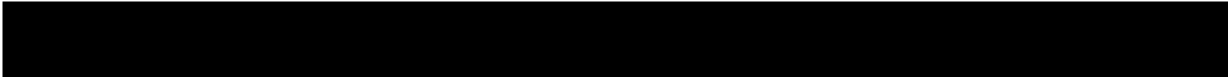
Improved Yields & Reliability

Paste Interconnects eliminate IPC 6012 plating defects

- Wicking
- Copper voids in holes
- Plating folds
- Thin plating
- Hole wall or barrel separation

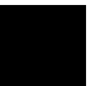
ZETA® LOCK





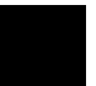
Guidelines for choosing B-Stage.

- Type
  - Most films suitable for flex (flow modified)
    - Pyralux LF, FR sheet adhesive.
    - Epoxy or polyimide blends (flow modified)
      - Zeta® Lock
  - Most No-Flow (very low flow) Prepregs.
    - Make sure they can tolerate heat from the pre-tack and Ormet tack dry bakes.



What is Zeta® Lock?

- Combines Integral Technology's Zeta® materials with the Ormet Circuits Sintering Conductive Paste
- Provides a dielectric film formulated to contain the conductive paste in the via
- Reduces cycle time and process steps saving time and money



Zeta® Lock Properties

- B-Stage Film based on a new polymer
- Compatible with the Ormet Process
  - Withstands pre-tack and paste dry
  - Contains paste to laser defined via
  - Flow modified for excellent paste interconnects
  - Laser ready polyester cap sheet
  - Tg - 195ºC   Td - 340ºC
  - Lead free assembly compatible
  - Halogen free
  - Standard PCB lamination equipment may be used
  - Dielectric Constant 3.4 (2 GHz @ 23°C)
  - Dielectric Strength 2400 volts/mil
  - Dissipation Factor .010 (2 GHz @ 23°)

Zeta Lock and Ormet 701

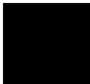
100 µ

46 µ

38 µ

Zeta Lock

Copper metallurgical bond



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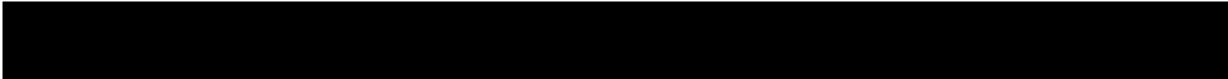

Zeta® Lock secures…

- Reliable sintered interconnects during lamination
  - Parallel fabrication process eliminates sequential yield loss
  - Increased Any Layer HDI for advanced designs
  - Combined offering in Zeta® Lock improved CTE matching
- Military and commercial markets
- Flex Rigid and Rigid PCB processing
- Working with OEM designers to educate on the design potential
- Zeta Lock and Ormet Paste can be used together or stand alone

Closing

Ormet and Zeta Lock can provide you. . . .

– More Reliable Interconnections
– Design Flexibility
– Delivered Faster
– Provided at Better Value

We are sure this can help you in your market today!!

Thank You

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