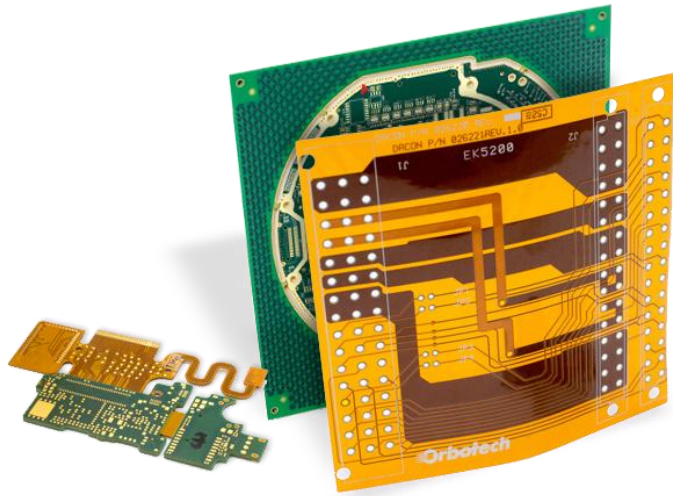




Fine lines? let's add

Balter Sagi Ph.D

CTO Eltek Ltd.

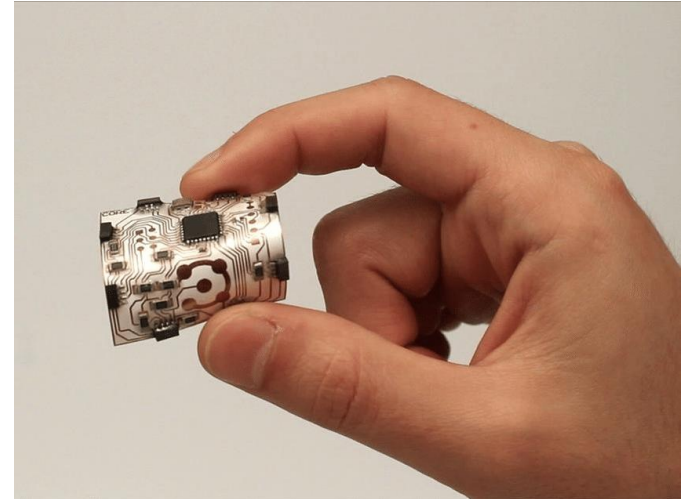
June 2021



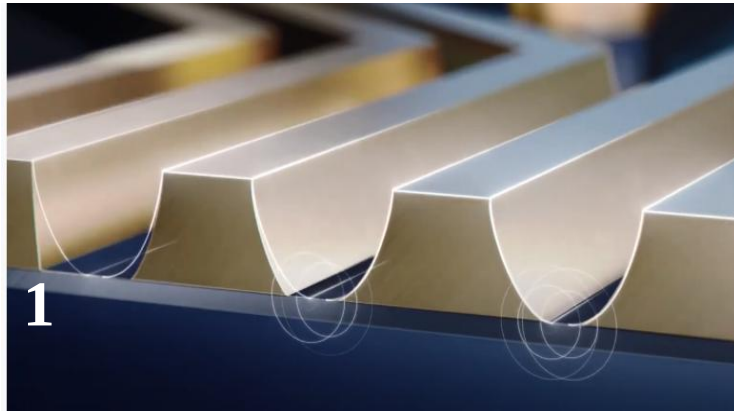
Customers request!

- Thin MLB; less than 0.4 mm
- Line/Space of 2mil and less
- 10 mil pads
- High quality of signal

mSAP/SAP technology is a key factor for PCB miniaturization.

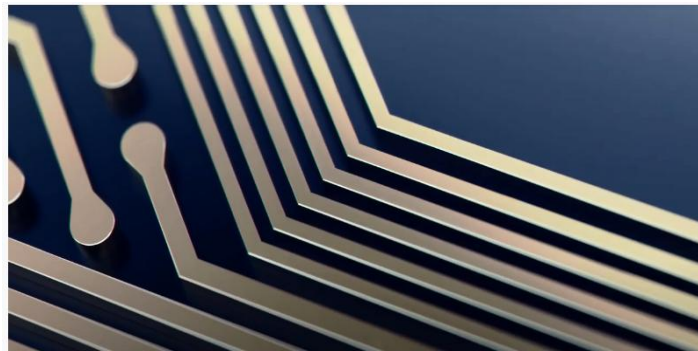


It's good to be Square



Conductor shape in: Subtractive (1) & Additive (2) processes

Less signals loss at high frequency data transmissions through straight line shape

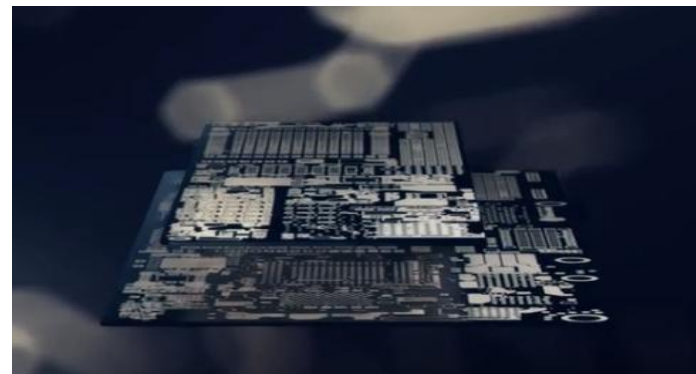
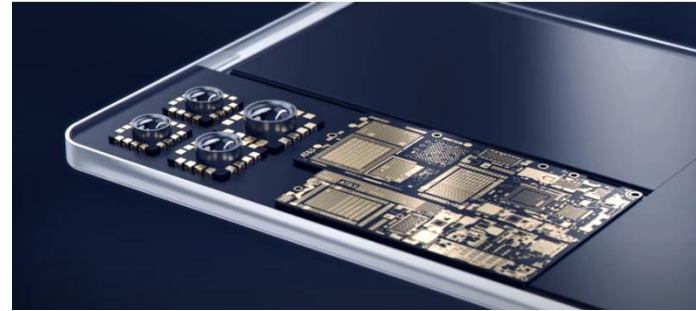


High performance at reduced board size

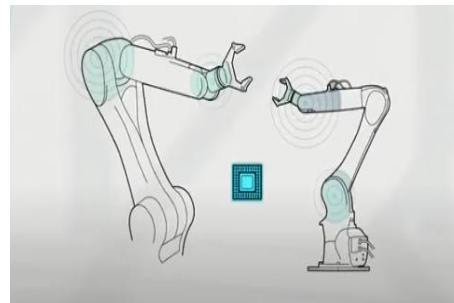
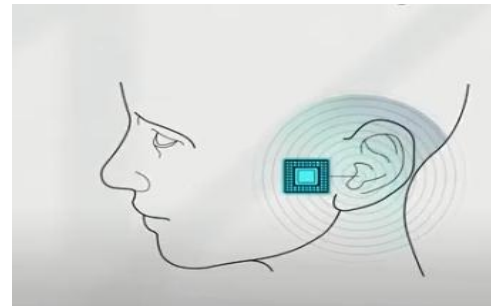
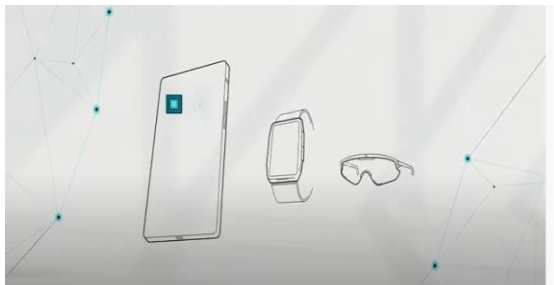
More is less

Vacant area for additional components

Advance “sandwich” structure: Extremely thin PCB



Applications



Technical Wording

- ❖ **Subtractive etch process:** This is the traditional flexible circuit fabrication technique. Starting with laminate consisting of polyimide or FR4 and Cu, the circuit pattern is formed by patterning and etching away the unwanted copper
- ❖ **mSAP/SAP:** Semi Additive Process – This process utilizes additive process steps, adding copper to the base dielectric rather than subtractive processes to create the circuit pattern

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Fine Line Resolution by Different Process

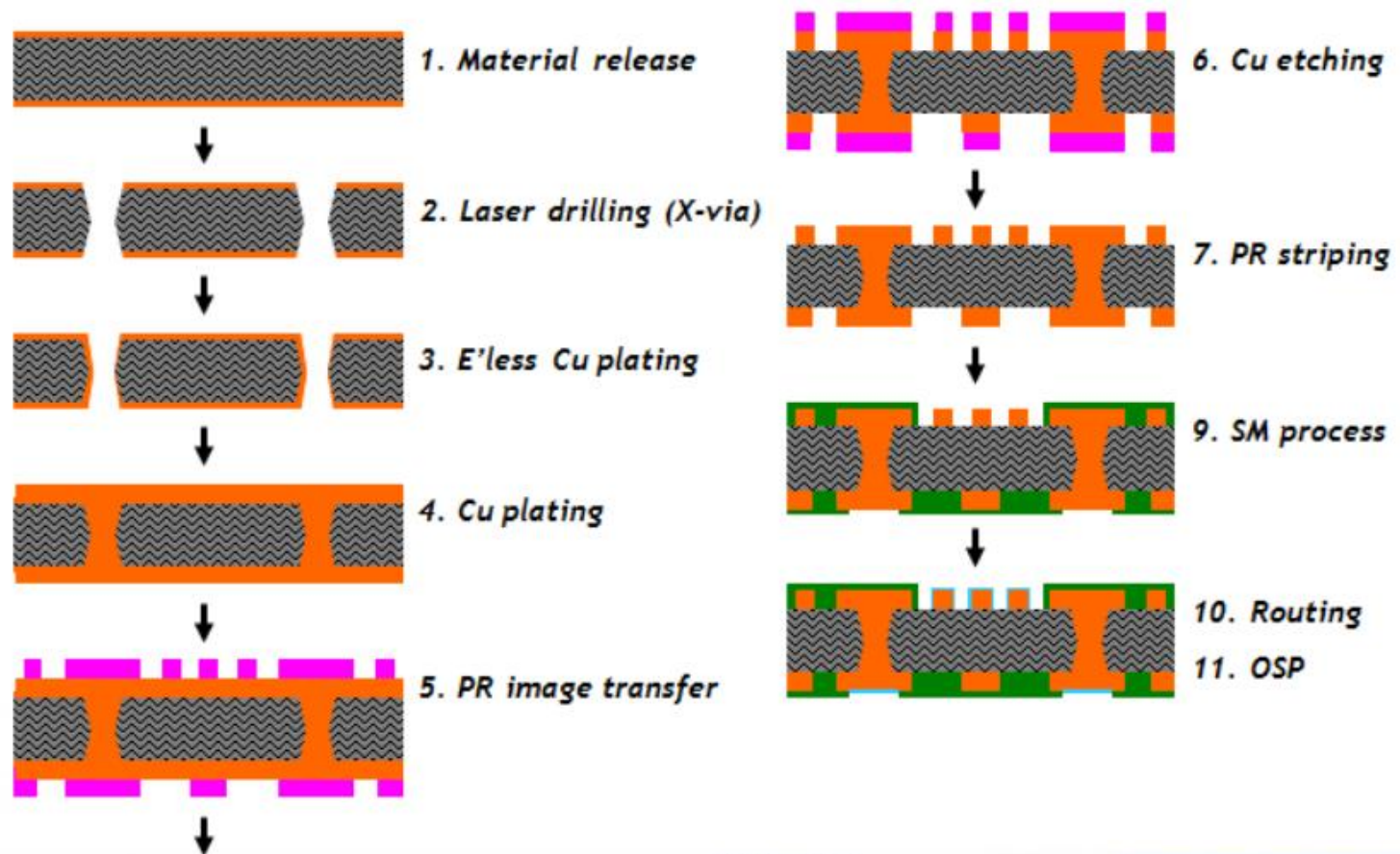


Subtractive	> 50 microns
M-SAP	• 25-50 microns
SAP	• 10-25 microns
A-SAP	• 5-10 microns

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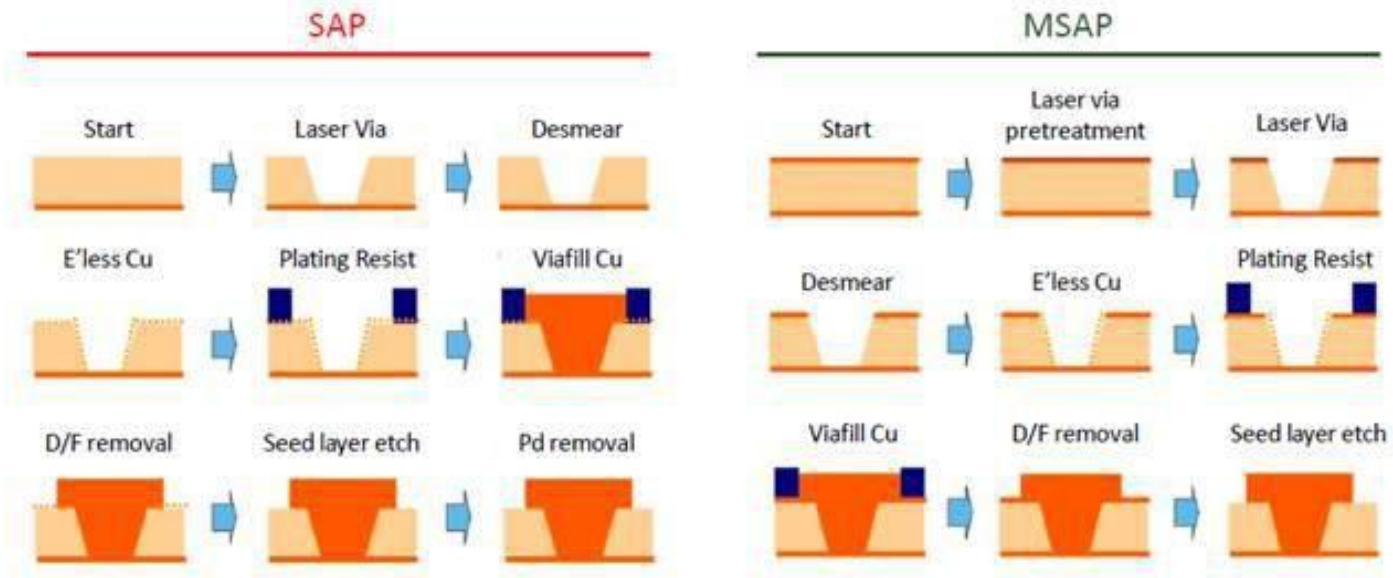
Fundamental Subtractive Process



Source: <https://www.dupont.com/electronic-materials/blogs/viewpoints/smartphone-functionality-new-metallization-processes.html>

Basics of mSAP/SAP

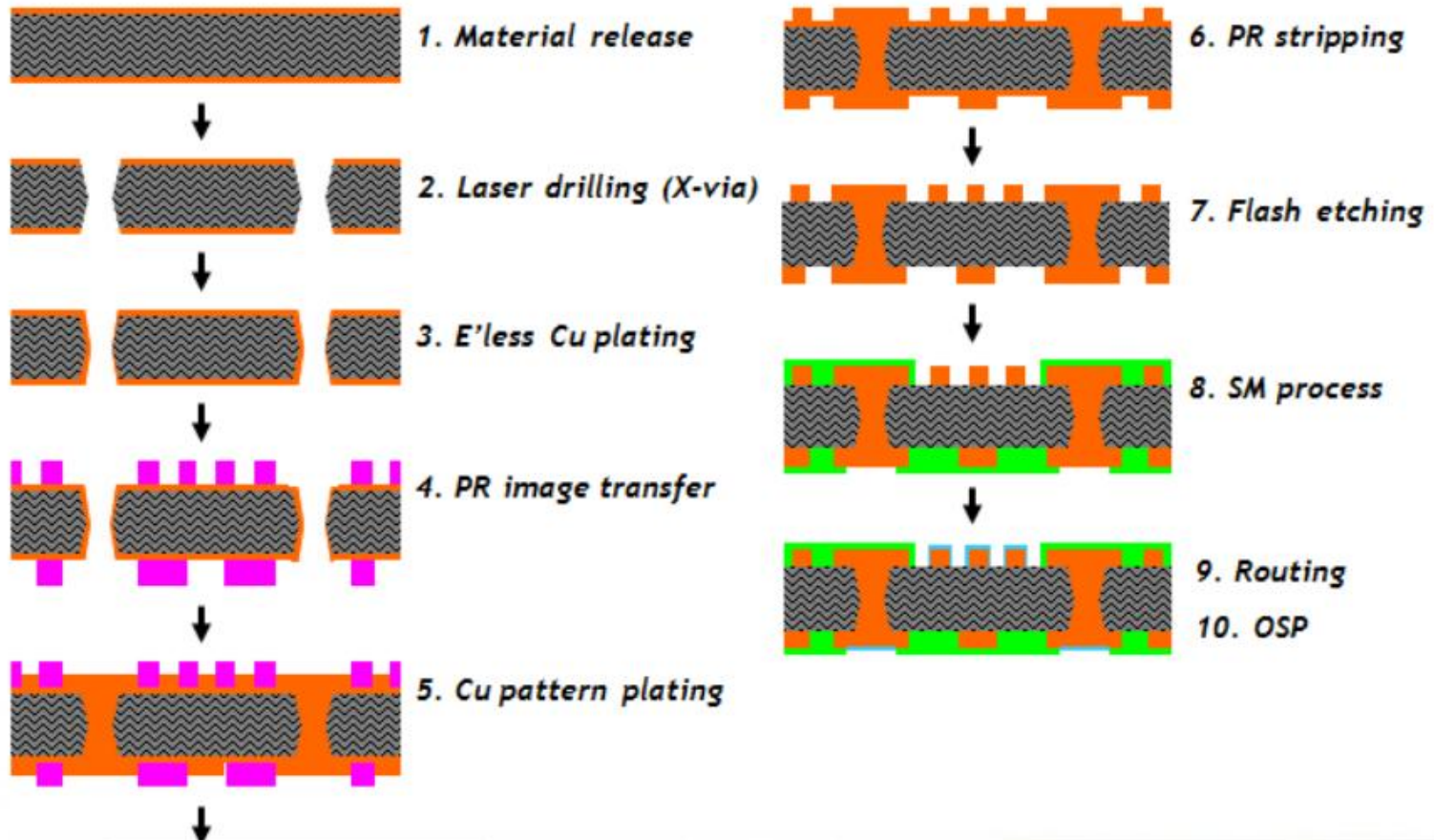
SAP vs MSAP



Difference	SAP		MSAP	
Start with	Dielectric (eg. ABF)	Proper desmear Adhesion promotion	Thin CCL, CCL with Cu reduction	High cost, Cu uniformity
Seed Layer	E'less Cu, Sputter	E'less Cu coverage, Adhesion	E'less Cu, E'less Cu + Flash Cu	E'less Cu coverage, Thick seed layer

Source: <https://www.dupont.com/electronic-materials/blogs/viewpoints/smartphone-functionality-new-metallization-processes.html>

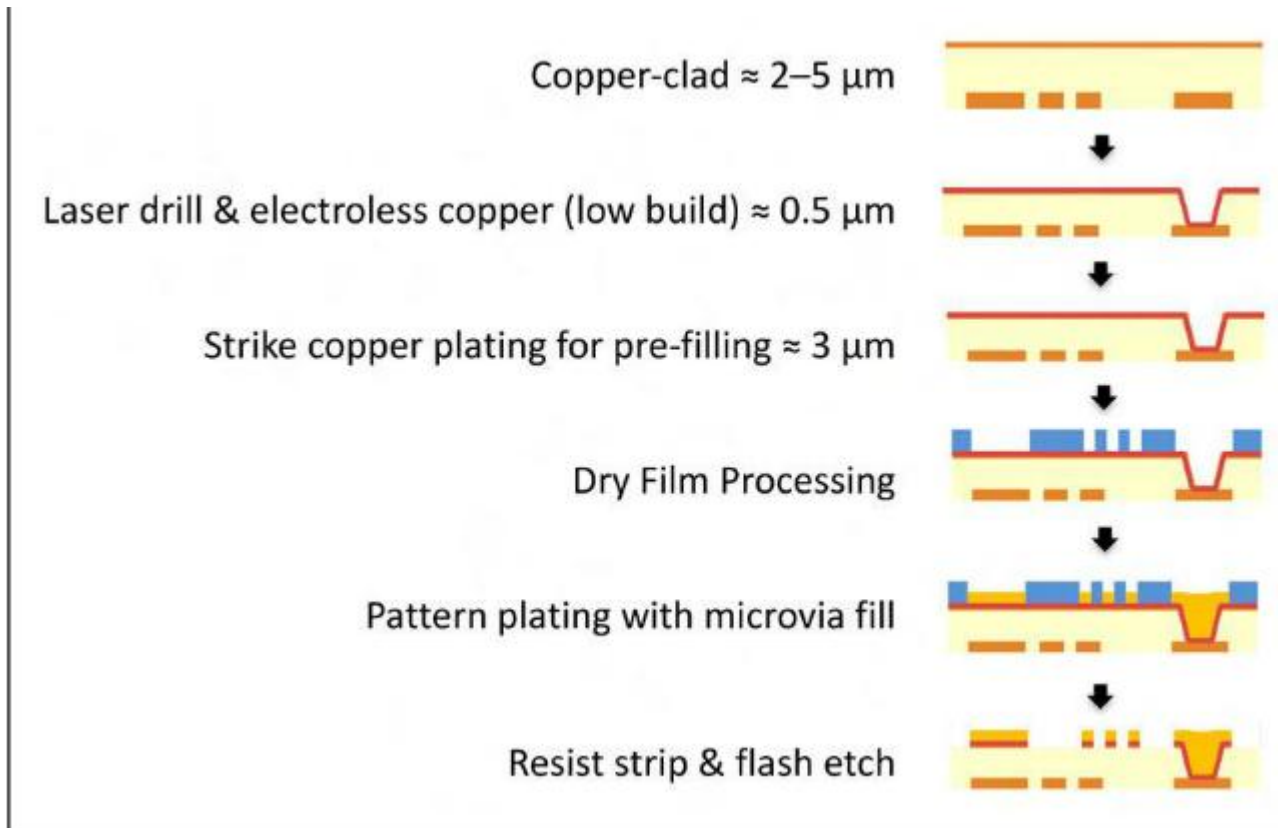
m-SAP Approach No. 1



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M-SAP Approach No. 2

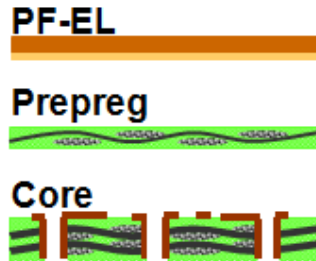


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Semi Additive Process

1. Construction



2. Hot press laminate



3. Drilling with laser



4. Desmearing (Hole cleaning)



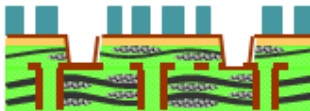
5. Copper foil etching



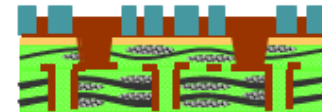
6. E-less copper plating



7. Dry film resist formation



8. Electro copper plating



9. Resist removal



10. Quick etching



Next step

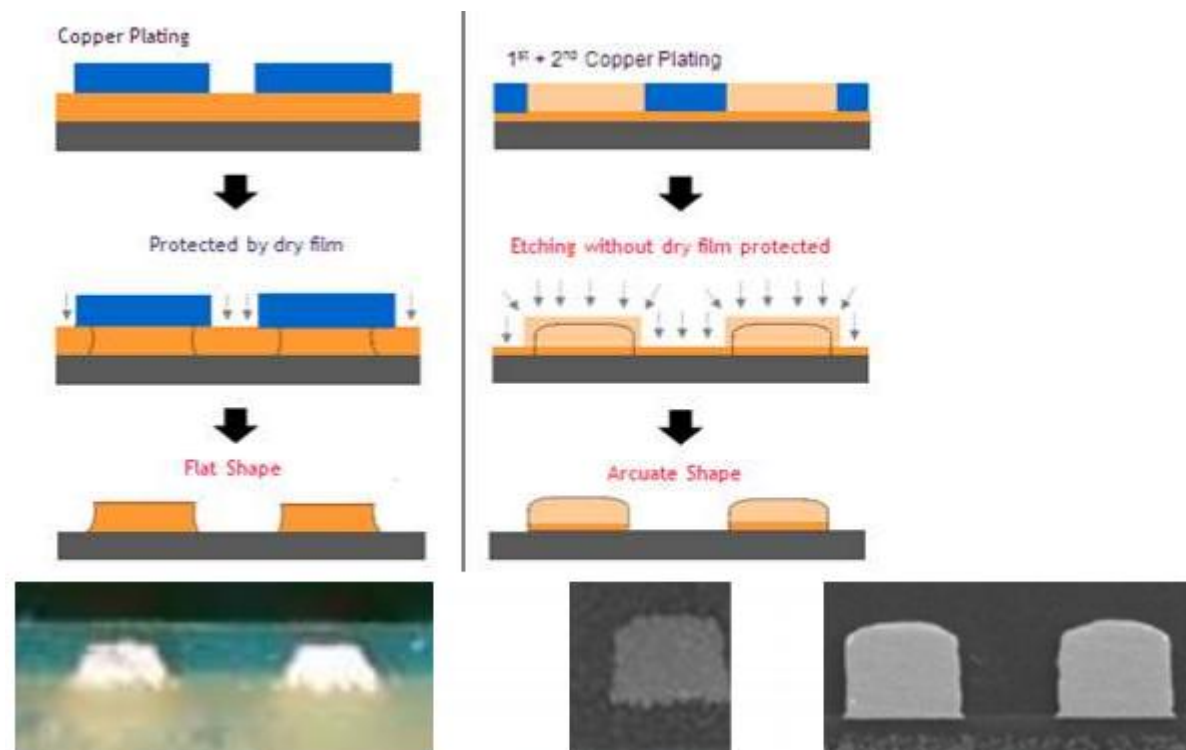
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Line Profile

Subtractive vs.SAP

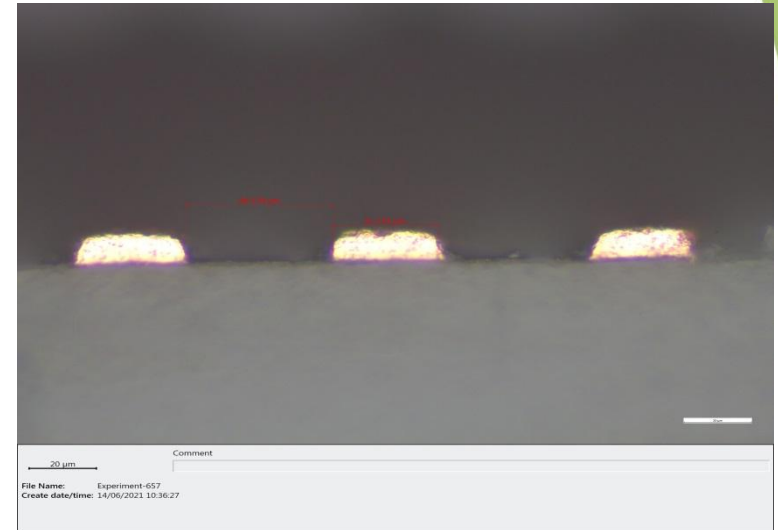
Process	Subtractive	M-SAP	SAP
L/S, Pitch	50/50, 100	25/25, 50	20/20, 40
Top	Flat	Round	Round
Head: Foot Ratio	$(1-(2/3CuT)):1$	1:1	1:1



Technology	AP	SAP	M-SAP
Substrate	Conductive Ink	ABF or Primer substrate	Cooper Foil/ CCL
Base copper	None	None	Yes
Copper layer	Pattern copper layer	Pattern copper layer + Pattern Plating Layer	Base Copper Layer + E- less Copper Layer + Pattern Plating
E-less Copper	0.5-6.0 μ	Above 1.0 μ	0.3-1.5 μ
Etching thickness	None	Panel Plating Copper Layer	Base Copper Layer + Panel Plating Copper Layer
Adhesion	Poor	Resin surface roughening or Molecular interface technology to improve adhesion	The resin is connected to the base copper and has good adhesion
Reliability	Easy to delamination, poor thermal stability	There is a risk of blisters	Good
Environmental impact	No etching, less pollution	Micro etching, less waste water discharge	Low etching, low wastewater discharge
Manufacturing cost	Low	High	Medium

Our pride-1.2/1.6 mil L/S

mSAP lines before flash etch



Thank you



- Special thanks to our R&D team:
 - Vitaly Bensman
 - Revital Balter
 - Edward Szpruch
 - Zila Droskin

Sources of Information

- ❖ **Modified Semi-Additive Process Introduction.** Liu Binyun / Ye Shaoming Guang
Dong Toneset Science&Technology Co., Ltd.
- ❖ **SAP Utilizing Very Uniform Ultrathin Copper.** Article by Steve Iketani and Mike
Vinson AVERATEK CORPORATION.
- ❖ **SAP and mSAP in Flexible Circuit Fabrication.** Tara Duun.
- ❖ <https://www.ccp.com.tw/ccpweb.nsf/ProductEN?OpenAgent&Product=COPPER%20FOIL>
- ❖ <https://www.doosansolus.com/en/business/c-foil/>
- ❖ <https://www.mitsui-kinzoku.co.jp/project/douhaku/en/searchProducts/>
- ❖ <http://www.hitachi-chem.co.jp/english/products/bm/index.html>

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