南亞 高頻高速銅箔簡介

2023

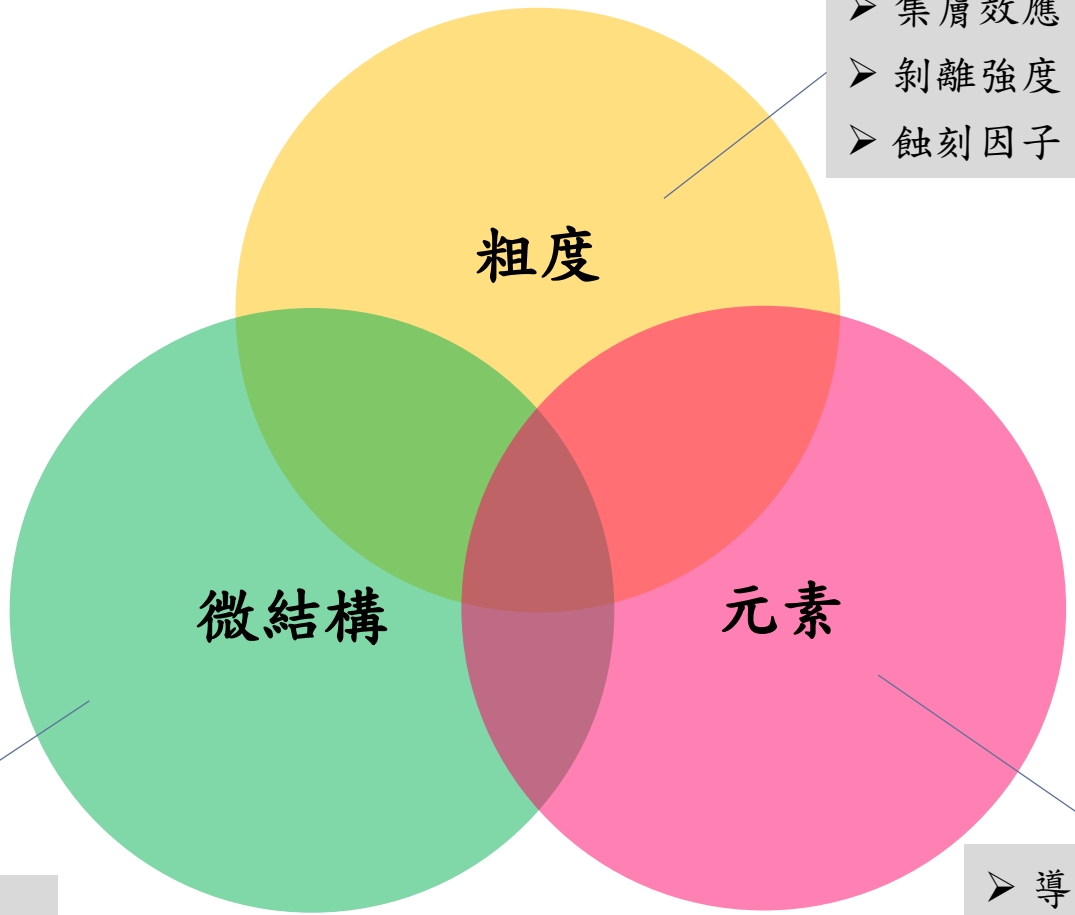
南亞高頻高速用銅箔

Grade		Product	Laminated Side				Status
			Contacting Roughness (μm)		Optical Roughness (μm)		
			Ra	Rz	Sa	Sz	
RTF	**RTF**	TLCHP	0.25	2.0	0.42	4.0	●
	RTF2	H1 / H1V	0.20	1.5	0.20	2.2	●
	RTF3	H1A	0.18	1.2	0.15	1.8	●
HVLP	**HVLP**	TLC-V2	0.25	2.1	0.35	3.3	●
	HVLP2	TLC-V1	0.22	1.5	0.27	2.7	●
	HVLP3	V1A	0.19	1.2	0.22	1.8	●
	HVLP4	VHA	0.16	1.0	0.20	1.5	開發中
PTFE	**RTF**	HW2	0.27	2.2	0.45	4.5	●
		HW1	0.25	1.7	0.32	3.5	●
	HVLP	VW	0.20	1.3	0.25	2.0	開發中

厚度規格: 12~70 μm

●: 量產品
開發中: 開發中

高頻高速PCB用銅箔設計



- 集膚效應
- 剝離強度
- 蝕刻因子

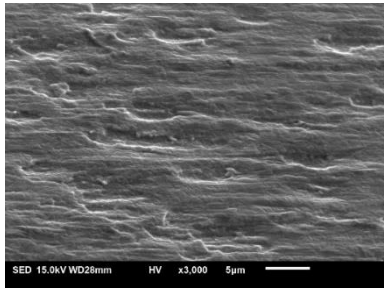
- 蝕刻因子

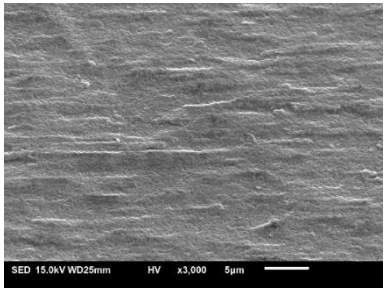
- 導電性
- 耐熱性

生箔工藝

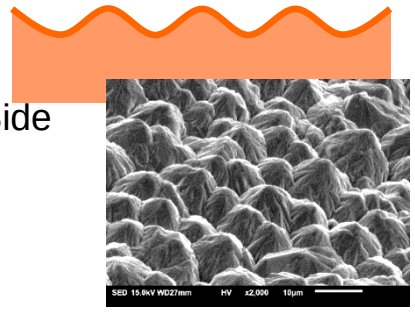
降低粗度

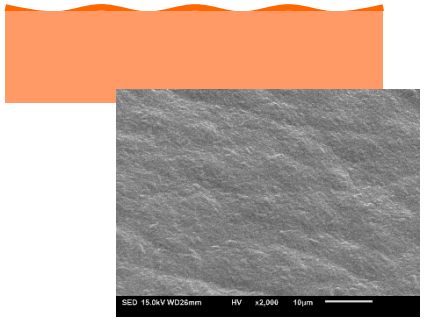
Shiny Side
(drum polish)

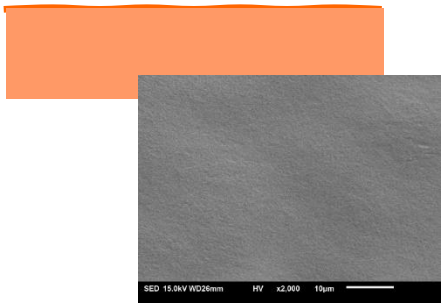




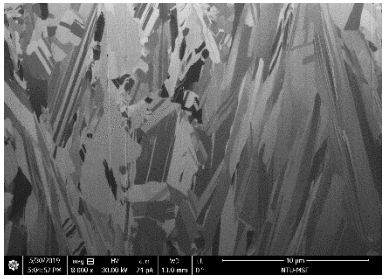
Matte Side

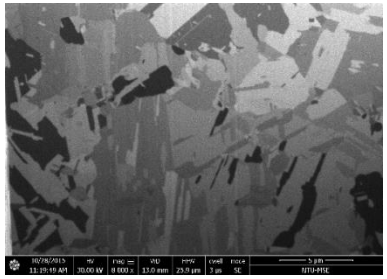


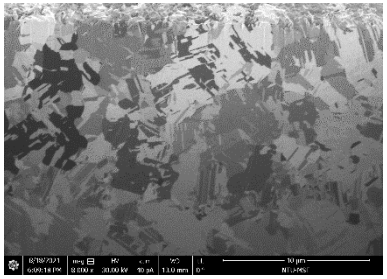




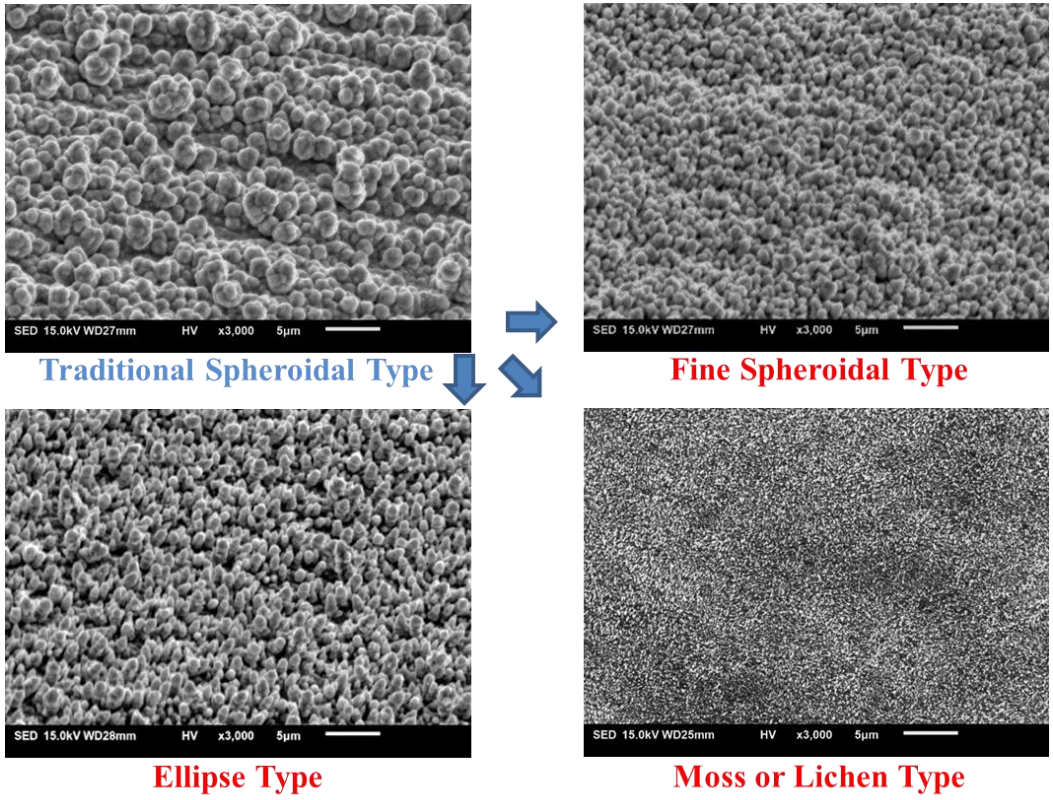
Microstructure







銅瘤設計

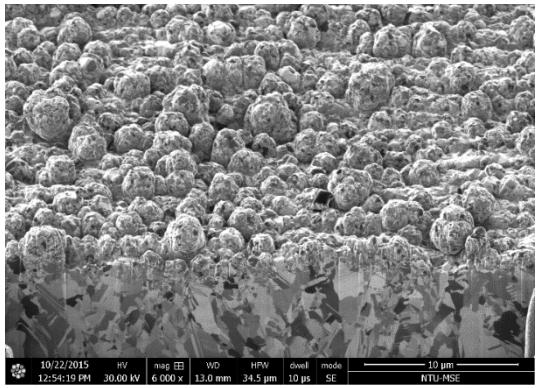


- 由先進粗化技術控制表面粗度、銅瘤型態與晶粒尺寸，減少訊號損耗。
- 球狀瘤狀物 ⇒ 細晶粒 ⇒ 絨毛狀

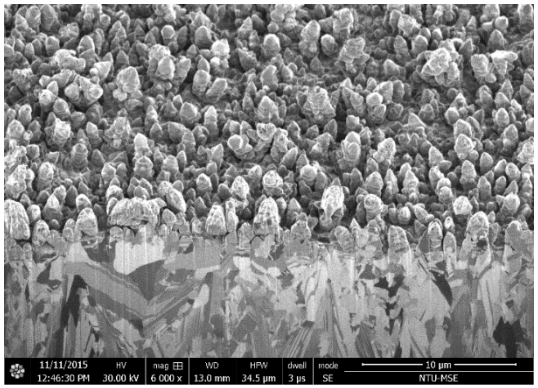
Low Roughness RTF – TLCHP

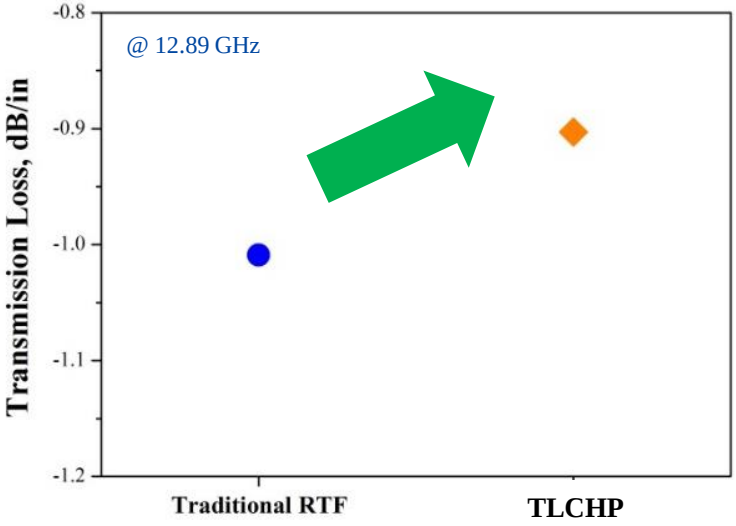
- 反轉處理銅箔
- Rz≦ 2.5μm
- 剝離強度≧ 5.0 lb/in (tested by NPG-170D)
- 橢圓銅瘤結構具有低粗度和高剝離強度的特性，適合低損耗PCB應用。

Traditional RTF



TLCHP





Loss improvement is about 12%

- 配合低粗度、高剝離強度及低信號損耗失需求，使用了細晶粒粗化技術來改變銅瘤型態與降低銅瘤粒徑。
- 跟傳統RTF箔相比，TLCHP有更細緻的晶粒尺寸及更均一的結構，因此具有優良的訊號完整性。

Very Low Roughness RTF2 – H1

特徵

- **Rz≦1.5μm**
- **良好的插入損失**
- **優異的尺寸安定性**

應用

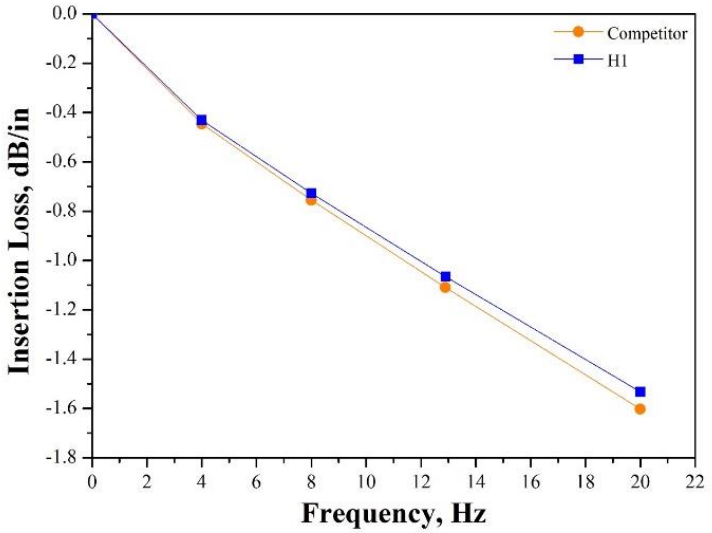
高端伺服器/路由器
光網絡/ Switch

Material: NPG-170D

PCB: 3 LB Stackup

4mil core(3313*1)+3313 PP*1

Measurement: Delta-L



➢ H1 訊號完整性優於他社銅箔。

Typical Properties

Product		H1	Competitor
Area weight (g/m²)		283	285
Contacting roughness Ra / Rz (μm)	Resist side	0.74 / 4.7	0.88 / 5.2
	Laminated side	0.22 / 1.3	0.24 / 1.6
Non-contacting roughness (μm)	Sa	0.26	0.34
	Sq	0.32	0.43
	Sz	2.6	3.3
Peel strength(lb/in)	NPG-170D	4.5	4.6
Peel loss after soaked in 12%HCl for 1 hr (%)		3.0	3.5
Percentage of Loss after being heated 121℃ 2hr (%)		5.0	35.5

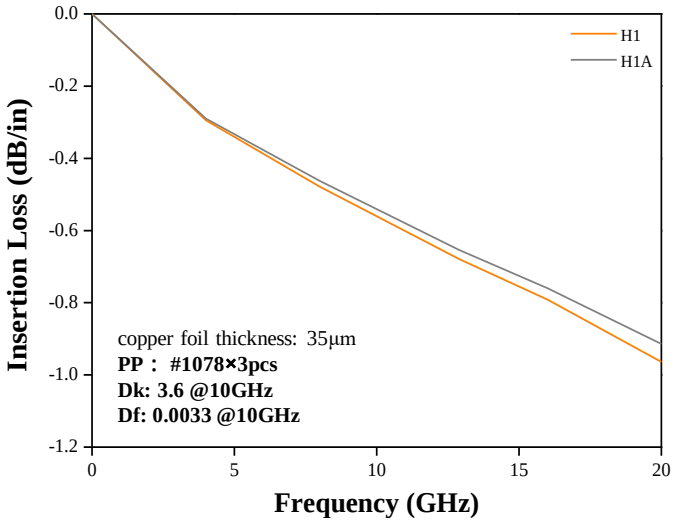
Very Low Roughness RTF3 – H1A

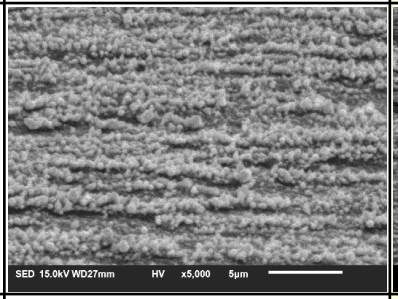
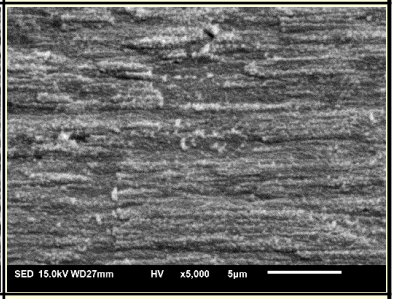
特徵

- **Rz≦1.3μm**
- **良好抗熱性**
- **優良的訊號傳遞特性**
- **優異的尺寸安定性**

應用

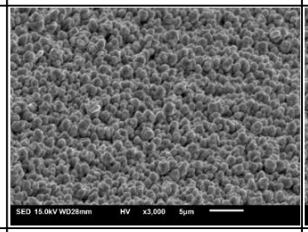
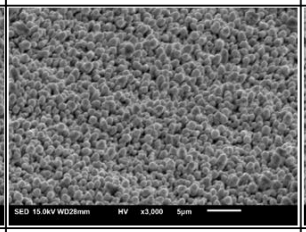
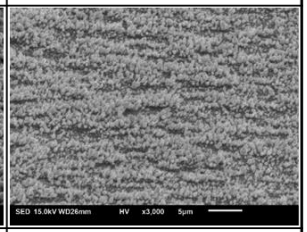
高端伺服器/路由器
光網絡/ Switch



品名		RTF2等級	RTF3等級
		H1	H1A
粗度 Ra / Rz (μm)	阻劑面	0.77 / 4.9	0.78 / 4.8
	壓合面	0.22 / 1.3	0.18 / 1.0
光學式粗度Sa/ Sz (μm)		0.26 / 2.6	0.20 / 1.7
SEM	壓合面		
剝離強度 (lb/in)		4.3	4.0
耐熱 (℃) (測試時間 60分)		285	295

➢ H1A的銅瘤較細緻、粗度較低，故H1A高頻電性優於H1。

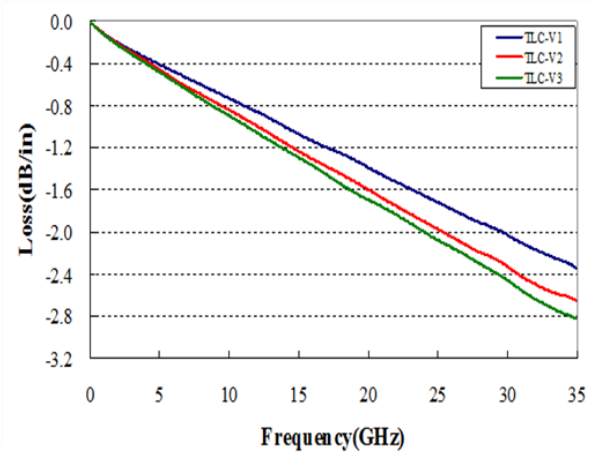
Very Low Roughness HVLP2 – V1

Product		TLC-V3	TLC-V2	TLC-V1
schematic diagram		VLP	HVLP	HVLP2
Nodule		Spheroidal 1.4 μm	Fine spheroidal 1.2 μm	Moss or Lichen 0.4 μm
Roughness, Ra/Rz (μm)	Resist side	0.20 / 1.3	0.23 / 1.3	0.18 / 1.1
	Laminated Side	0.54 / 3.5	0.27 / 2.2	0.20 / 1.3
Optical Roughness (Laminated Side)	Sa / Sq / Sz	0.74 / 0.91 / 5.96	0.41 / 0.39 / 3.43	**0.27 / 0.33 / 2.51**
SEM	Laminated Side			
Peel Strength (lb/in)	NPG-170D	5.2	4.9	4.5

Material: NPG-170D

PCB: 3 LB Stackup
4mil core(3313*1)+3313 PP*1

Measurement: Delta-L

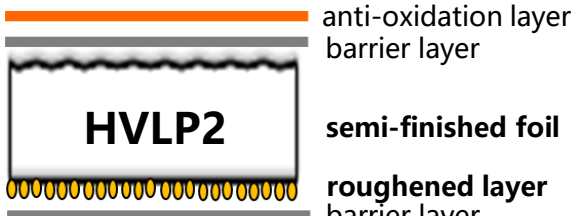


➢ 粗化技術調整壓合面的銅瘤型態與尺寸，降低銅箔粗糙度，有效提升高頻訊號完整性。

Very Low Roughness HVLP3 / HVLP4 – V1A / VHA

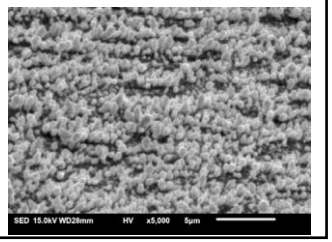
HVLP2 type

V1 copper foil



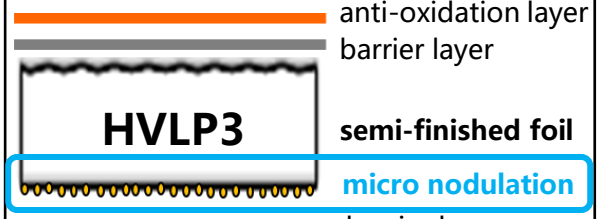
Rz: 1.5 μm

Sz: 3.2 μm



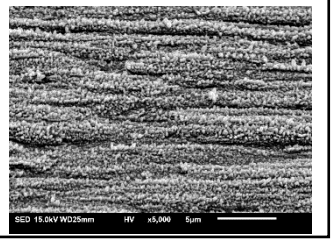
HVLP3 type

V1A copper foil



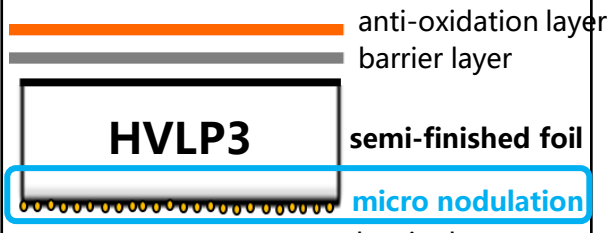
Rz: 1.0 μm

Sz: 2.0 μm



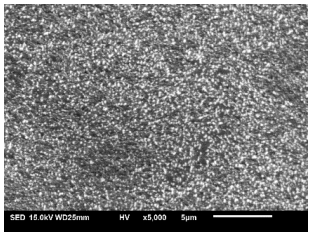
HVLP4 type under development

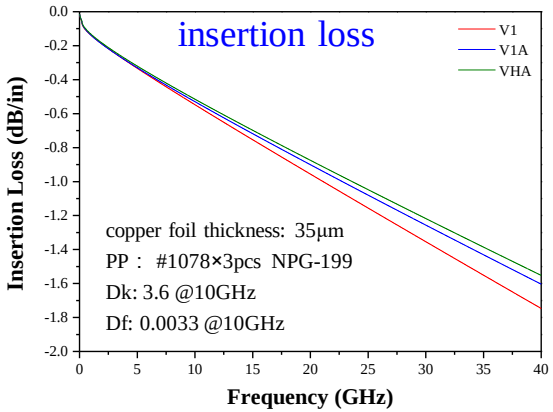
VHA copper foil

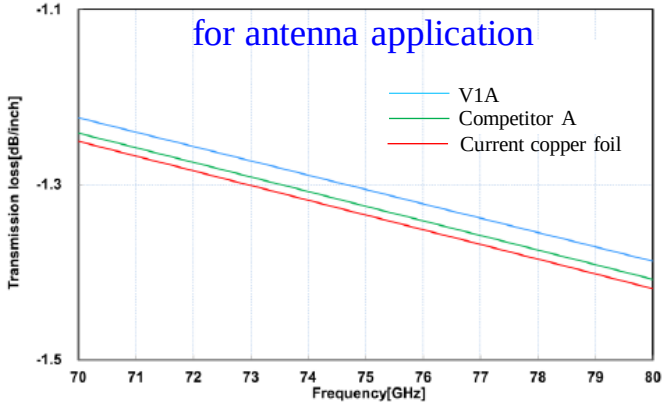


Rz: 0.8 μm

Sz: 1.6 μm







➢ 南亞HVLP3及HVLP4等級銅箔，分別為V1A及VHA，都具有良好的訊號完整性。

研發藍圖

最終需求	銅箔開發	~ 2022	2023	2024	2025
•Low Df •Low Dk •Low CTE	•超低粗度 •優良訊號完整性 •高剝離強度 •良好耐熱性 •良好剛性	**•HVLP2** V1、V1V Rz≦1.5 μm **•RTF2** H1、H1V Rz≦1.5μm **•For PTFE** HW1、HW2 Rz≦2.5μm	**•HVLP3** V1A Rz≦1.0μm **•RTF3** H1A Rz≦1.0μm	**•HVLP4** VHA Rz≦0.8μm **•For PTFE** VW1 Rz≦1.5μm	**•Profile-free** Rz≦0.5μm Sz≦1.0μm

Thank you

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