

RISHO PCB Materials



SINCE 1921

利昌工業株式会社

RISHO KOGYO CO., LTD.

*Be the **Last one** in the industry
with standard technology*

*Be the **Only one** in the industry
with high-technology*



RISHO Company Profile

- Foundation : October, 1921 (100 years old in 2 years!!!)
- Annual Revenue : 170M USD
- Number of Employee : 740

Business Outline

1. Electronics

Copper Clad Laminates, Epoxy Glass Tape, Rubber Clad Laminates

2. Industrial Material, Electrical Insulating Material

Laminated Board, Backup/Entry Board, Laminated Tube

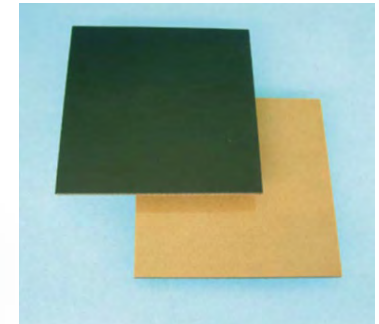
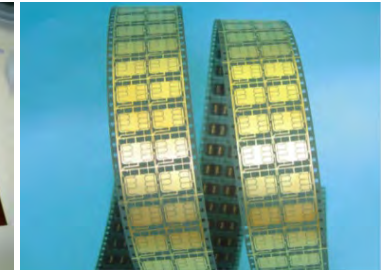
3. Epoxy Molded Electrical Products

Potential Transformers, Current Transformers, Capacitors, Reactor, Insulator

RISHO CCL



Epoxy Glass Tape

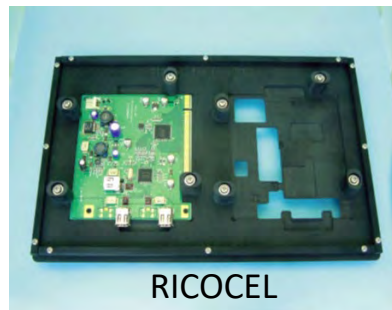


Phenolic /Rubber
Clad Laminates



Laminated Tube

Solder Pallet



RICOCEL



Phenolic Paper Laminates

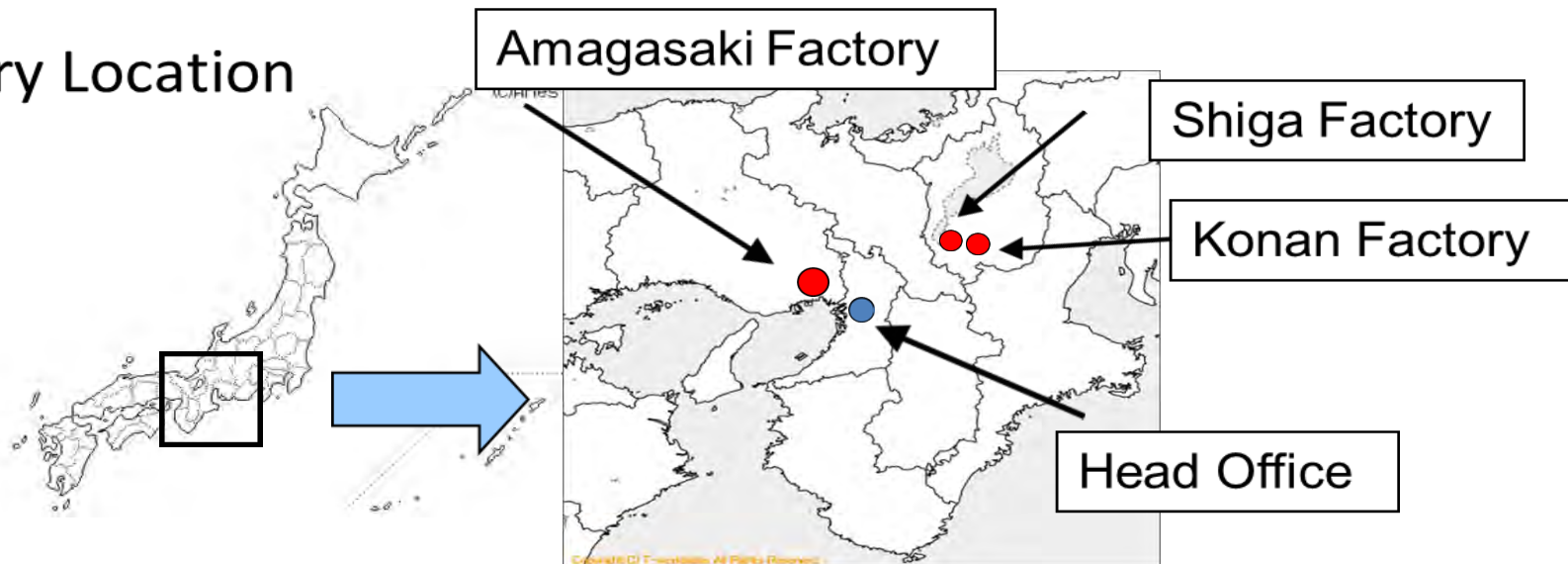


Transformer

Branches and Affiliated Companies

- Head Quarters : Osaka in Japan
- Sales Office : Osaka, Tokyo, Nagoya and other 9 domestic branches.
- Overseas Sales Office : Taipei, Seoul, Singapore, Frankfurt, Wuxi
- Factory : Amagasaki, Shiga, Konan (ISO9001 & 14001 Certified)
- R&D : Amagasaki Factory
- Affiliated Companies:
 - Risho Singapore Pte., Ltd.
 - Risho Enterprises (Car Driving School)
 - Risho Kogyo (Wuxi) Electric Co.,Ltd. (ISO9001 & 14001 Certified)
 - Risho Kogyo (Wuxi) Chemical Co.,Ltd. (ISO9001 & 14001 Certified)

Factory Location



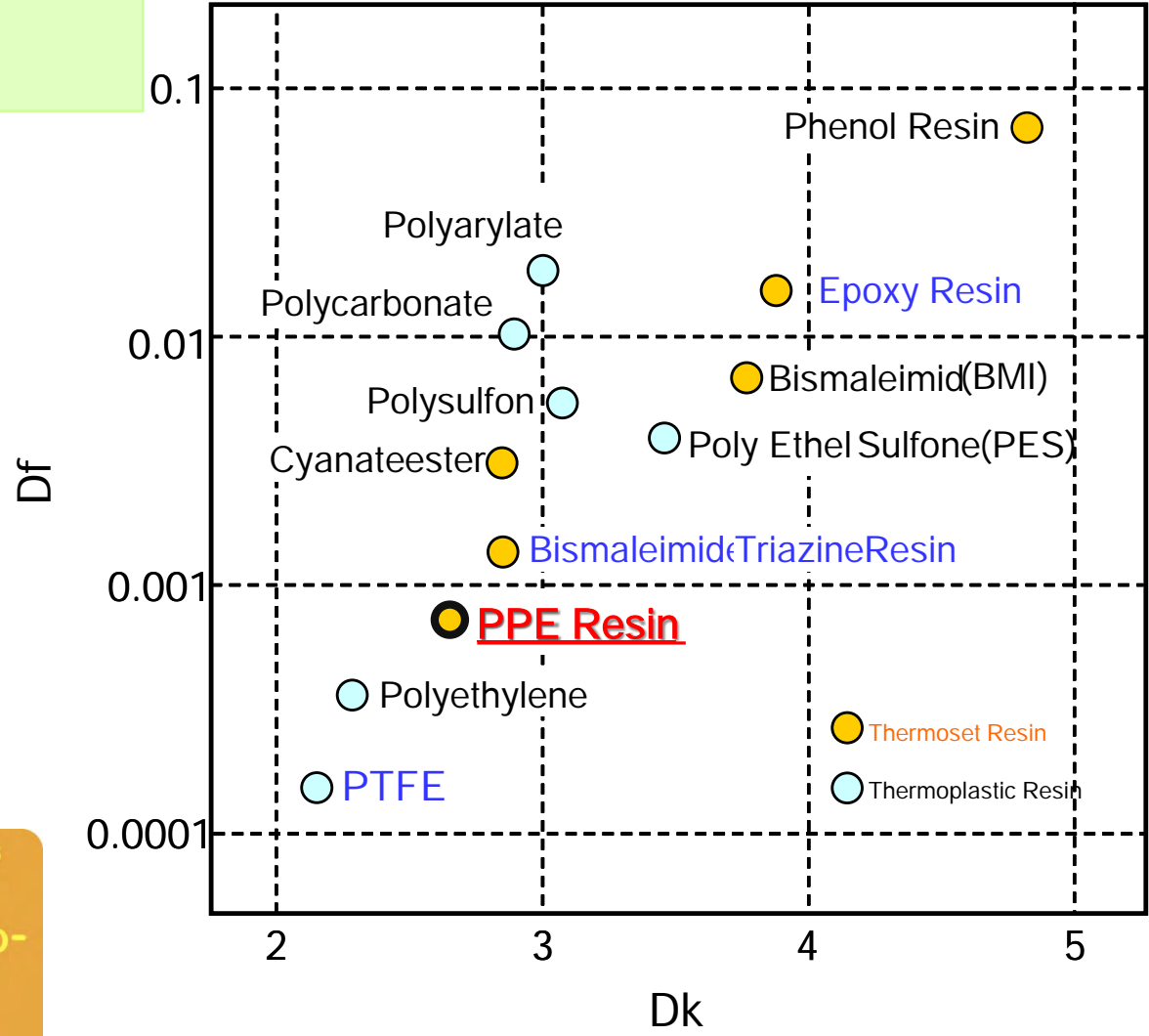
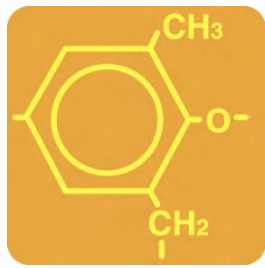
High-Speed Low-Loss Materials for Telecom Application and Antenna

RISHO CCL Materials for Antenna PCB

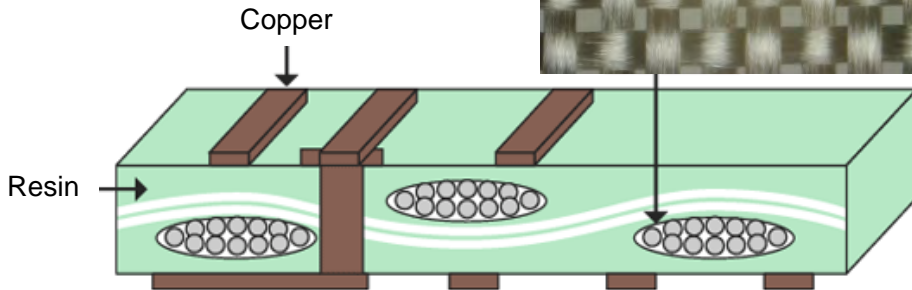
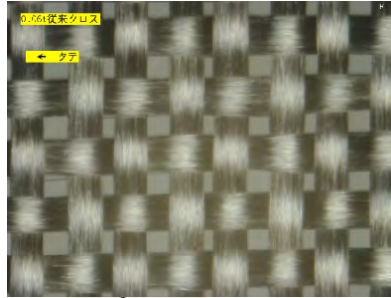
High-Speed PCB Materials based on PPE Resin

【Characteristics of PPE Resin】

- Excellent Dielectric Property
(Stable for frequency and temperature)
(Low Dk, Low Df)
- Superior Tolerance of Thickness
(Good Impedance Control)
- High Thermal Resistance, High Tg
- Low Water Absorption
- Excellent Processability



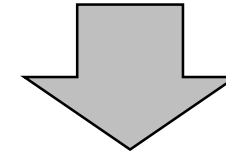
Glass Cloth



Cross Section of PCB

IPC SPEC	Thickness	Weight (g/m ²)	Density (count/25mm)	
	(mm)		Warp	Fill
106	0.035	25	56	56
1078	0.043	48	54	54
1080	0.055	47	60	46
3313	0.075	83	60	62
2116	0.095	104	60	58
7628	0.180	209	44	32

		E-glass	Low Dk glass
Density	g/cm ³	2.6	2.3
CTE	ppm/°C	5.6	3.3
Dk	(1GHz)	6.8	4.8
Df	(1GHz)	0.0035	0.0015

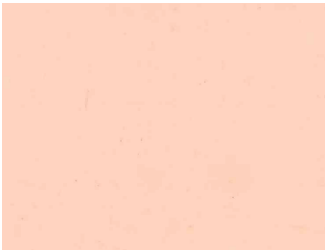

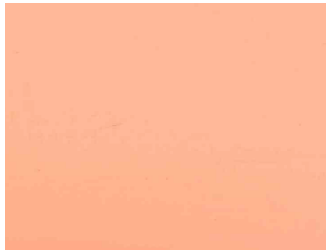
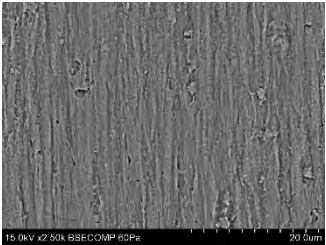
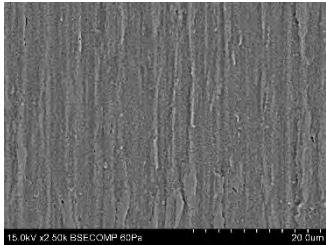
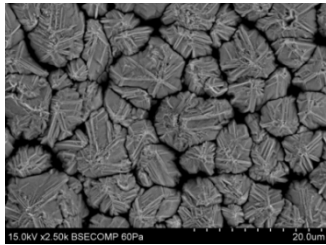
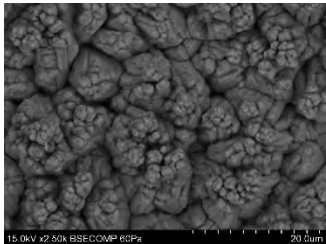
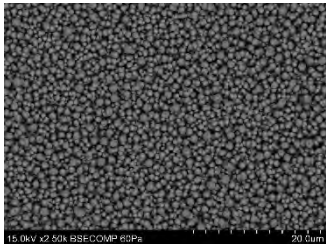
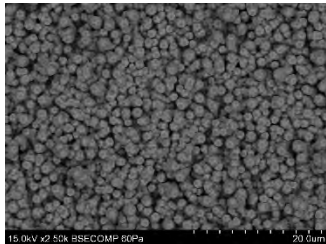


Dk is determined by the ratio of resin and glass cloth.

$$\epsilon_{lam} = \frac{V_1 \cdot \epsilon_1 \cdot [2/3 + \epsilon_2/3\epsilon_1] + V_2 \cdot \epsilon_2}{V_1 \cdot [2/3 + \epsilon_2/3\epsilon_1] + \epsilon_2}$$

- ϵ_{lam} : Dk of laminate
- ϵ_1 : Dk of resin(include filler)
- ϵ_2 : Dk of glass fabric
- V_1 : Volume% of resin
- V_2 : Volume% of glass fabric

Copper Foil

	Standard Foil	Low Profile Foil (LP)	RTF
Optical (S-side)			
SEM (S-side)			
SEM (M-side)			
M-side Roughness Rz(μm)	9	2	4
Note	Standard	Low Transmission Loss	Low Transmission Loss Low Cost

※RTF: Reverse Treated Foil

Advantages of RISHO PPE CCL

- Low (High) Dk and Df
- Low Water Absorption
- High Tg
- Excellent to thickness accuracy
(Range of thickness accuracy is only half of FR-4)
⇒ Easy to control impedance
- Good Processability (Equivalent to FR-4)
(Drilling, TH-plating, etc.)
- Multi-Layer process available with other materials

Hi-Speed Materials Lineup

RISHO

Base Resin	PPE Resin									Epoxy Resin	
Products	AD-3379	AD-3379M	CS-3379M	CS-3379	CS-3376G/GV	CS-3376C	CS-3396M	CS-3396	AD-3396	CS-3387S	
Glass Fabric	Bonding Sheet (Non)		E glass						Bonding Sheet (Non)		E glass
Dk (10GHz)	3.1	3.0	3.16	2.9 (Low Dk E glass)	3.09	3.27	7.27 (@8GHz)	11.3 (@1GHz)	16.5 (@1GHz)	3.92	
Df (10GHz)	0.0018	0.0015	0.0015	0.0033 (Low Dk E glass)	0.0046	0.006	0.006 (@8GHz)	0.003 (@1GHz)	0.003 (@1GHz)	0.012	
Low Profile Copper Foil	✓	✓	✓	✓	✓			✓		✓	
Prepreg			Now Developing	✓			✓	✓	✓	✓	
Halogen Free							✓	✓	✓	✓	
Flammability	V-0 eqv.	V-0eqv.	V-0eqv.	V-0	V-0	V-0	V-0 Equiv.	V-1	V-0 Equiv.	V-0	
Typical Application	Servers, Routers, mm-Wave Antenna				Antennas, Amplifiers, Wi-Fi, DSRC			Antennas, Military, Aerospace, GPS		Device Embedded	Antennas, RFID

Line-up

AD-3379, CD-3379

【Product Type】

Bonding Sheet, RCC

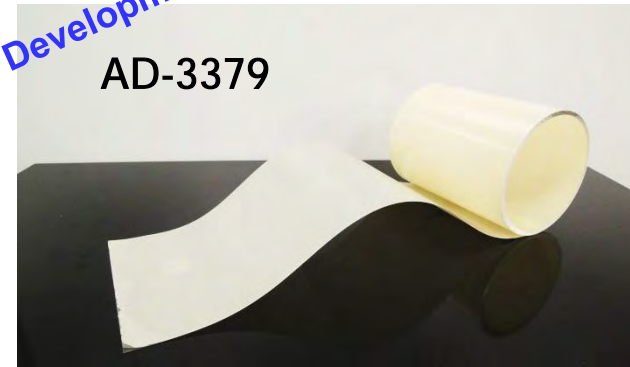
【Application】

- Bonding Sheet, Build-up Film

【Features】

- Isotropy of Dk and Df due to no glass cloth
⇒ Skew Reduction
- **Dk=2.9 / Df=0.002** (1GHz)
- High Tg: 240°C

Under Development



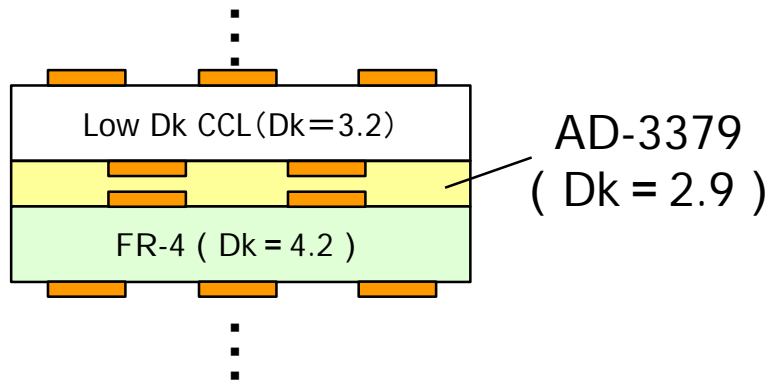
Product code	Unit	Under Development AD-3379
Dk (1GHz)	-	2.9
Df (1GHz)	-	0.002
Tg(DMA)	°C	240
CTE Z (α_1/α_2)	ppm/°C	38 / 41
Water absorption	%	0.08
Flammability	-	V-0 Equiv.
Multi layer process	-	○
Halogen free	-	×

Line-up

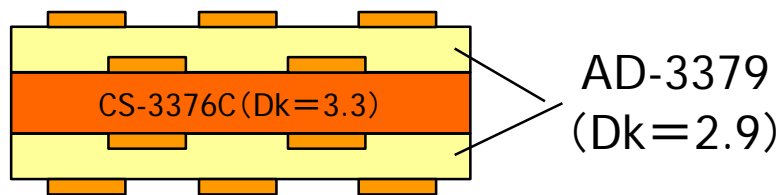
AD-3379

◆Application

High-Speed Multi-Layer Board

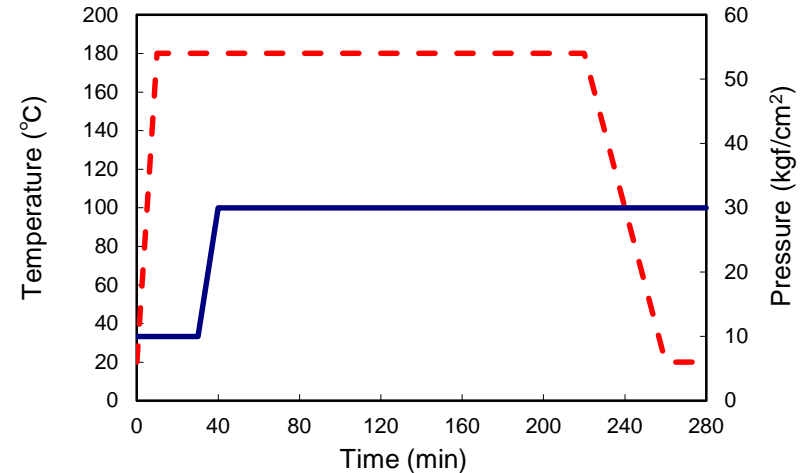


◆Heat Resistance Test (Humidity Reflow)



Core Material : CS-3376C (0.4t, Cu18)
Inner Layer Copper Foil Treat: BO treat
Outer Material: AD-3379 (0.1t)

◆Laminate Press Condition



Temperature (°C)	Pressure (kgf/cm ²)
180°C / 210min	10kg / 30min ⇒ 30kg / until cooled

【Test Condition】

Humidify: 40°C/90%/24Hr

Reflow : 255°C peak × 6times

【Test Result】

	1 time	2 times	3 times	4 times	5 times	6 times
appearance	OK	OK	OK	OK	OK	OK

No abnormal issue on appearance after reflow

Line-up

CS-3379M

【Product Type】

Double-Sided CCL

【Application】

- mmWave Radar, 5G Antennas, Satellite, Wi-Fi and GPS Antennas

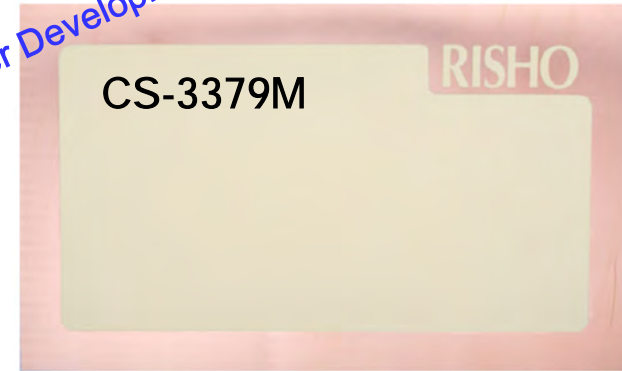
【Characteristics】

- Low Dk and Low Df

Dk=3.2 / **Df=0.0015 at 10GHz**

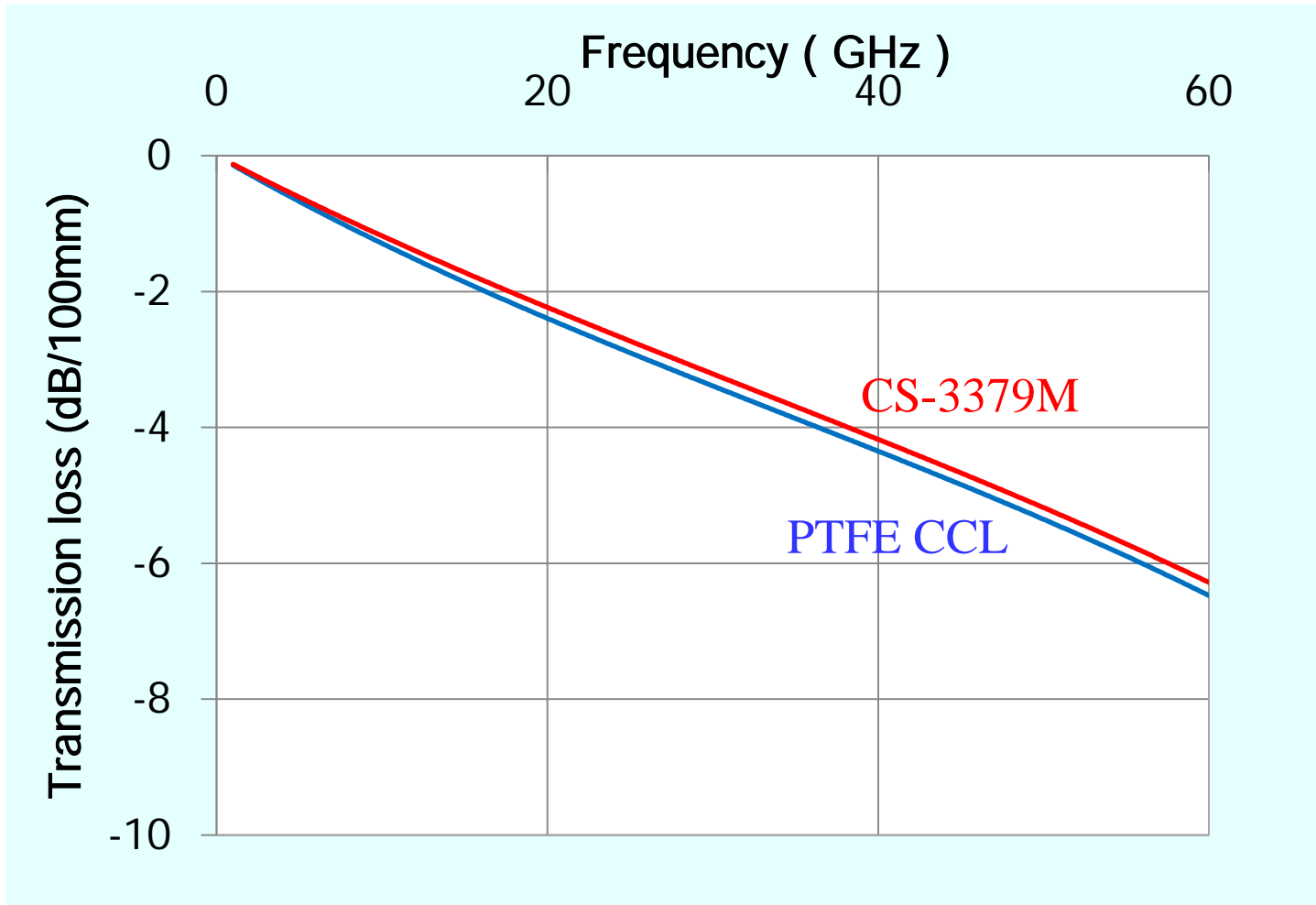
- **Low Transmission Loss at mmWave Band**
- **High Thermal Conductivity: 0.6W/mK**
- High Cost Performance

Under Development



Product Code		Unit	Under Development CS-3379M
Dk	1GHz	-	3.2
	10GHz		3.2
Df	1GHz	-	0.0010
	10GHz		0.0015
Tg (DMA)		°C	205
CTE Z (α_1/α_2)		ppm/°C	30 / 150
Water Absorption		%	0.03
Flammability		-	V-0 Equiv.

Transmission Loss of CS-3379M

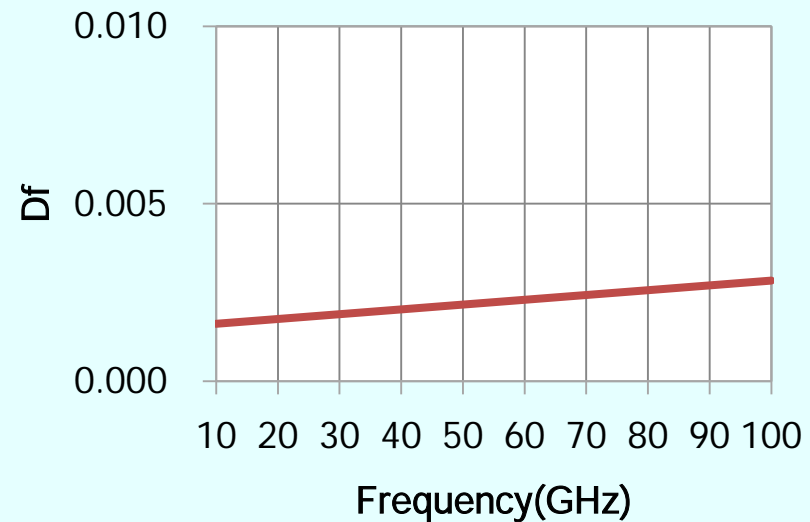
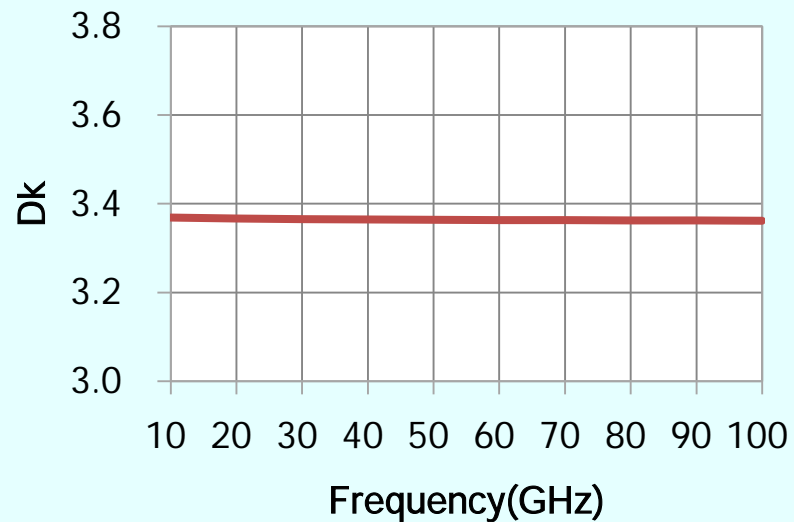


Transmission loss of CS-3379M is comparable to PTFE.

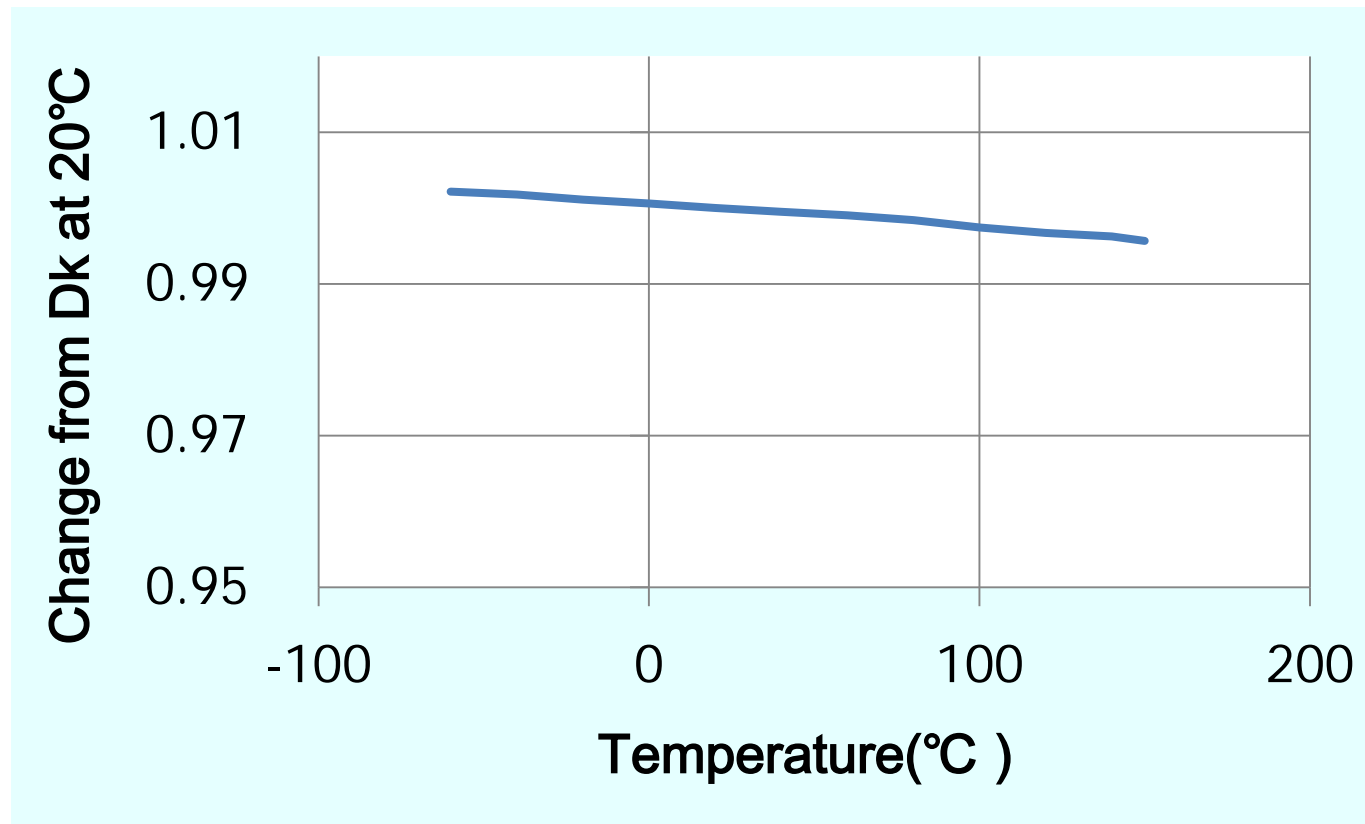
Dk/Df Frequency Dependence CS-3379 M

Test Method :

Balanced-type Circular Disk Resonator Method measured by FUJITSU



Dk Temperature Dependence of CS-3379M



Roadmap of Risho Materials for 5G Antennas

	2016	2018	2021
Material Property	<p>CS-3376G, GV Dk: 3.1 Df: 0.0029</p>	<p>CS-3379M Dk: 3.0 Df: 0.002 \geq</p>	<p>Dk: 2.8 Df: 0.001 \geq</p>
Copper Foil	<p>RTF</p>		
	<p>H-VLP</p>		
		<p>Profile-free</p>	

Thermal Solution Materials

High Thermal Conductive Material Lineup

White

AD-7006
0.3W/mK

Low Resin Flow Bonding Sheet

White

CS-3945
1.3W/mK

CCL

CS-3295, ES-3245
3W/mK

CCL, Prepreg

Glass Epoxy Laminate, Prepreg

Liquid Molding Compound
(One-Pack Type)
(1 - 4W/mK)

Liquid Molding Compound
(Two-Pack Type)
(1 - 7W/mK)

White

AC-7900
1W/mK

Al-base CCL

Low Modulus

AC-7303
3W/mK

Al-base CCL

AC-7200TY
5W/mK

Al-base CCL

AC-7208
8W/mK

Al-base CCL

New

AC-7210
10W/mK

Low Modulus

CC-7303
AD-7303
CD-7303
3W/mK

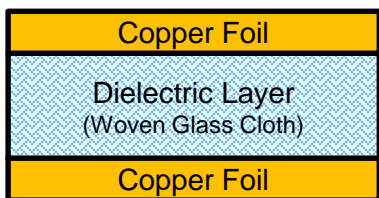
CC-7200TY
AD-7200TY
CD-7200TY
5W/mK

AD-7208
CD-7208
8W/mK

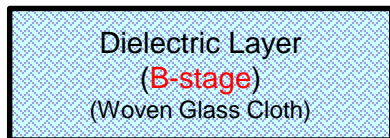
New

AD-7210
CD-7210
CC-7210
10W/mK

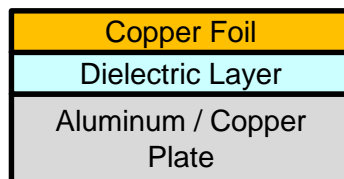
Bonding Sheet, RCC, Copper-base CCL without Glass Fabric



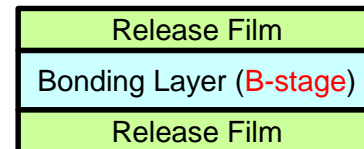
CCL (CS-XXXX)



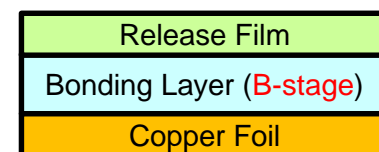
Prepreg (ES-XXXX)



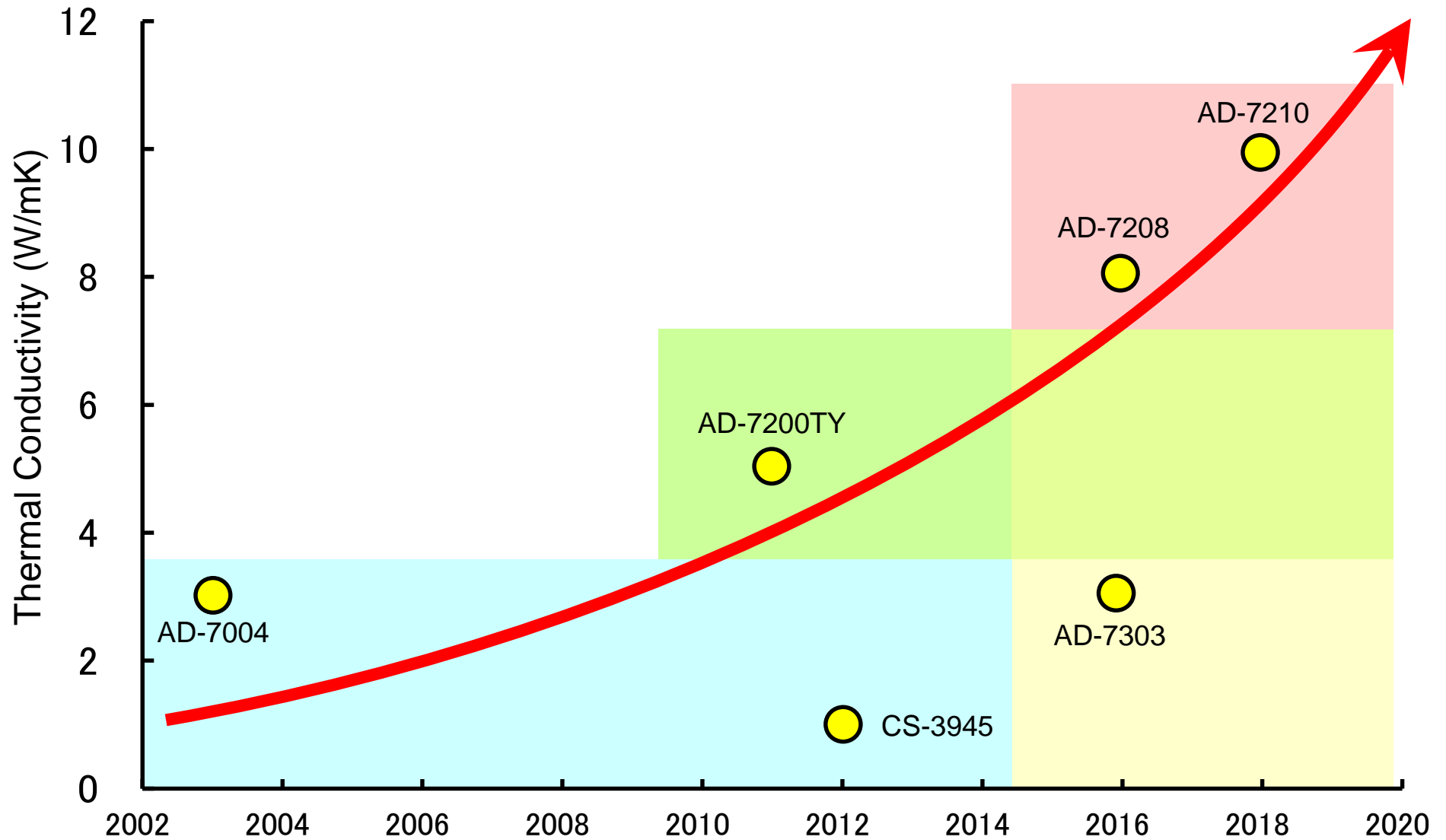
Metal base CCL (AC-XXXX)



Bonding Sheet (AD-XXXX)



RCC (CD-XXXX)



Thank you for your kind attention!!!