

IWPC Workshop, Stuttgart, May 2003:

Automotive Radar, Sensors and Communications Equipment > 20 GHz

PTFE Microwave Substrates - Mature Products for an Emerging Market

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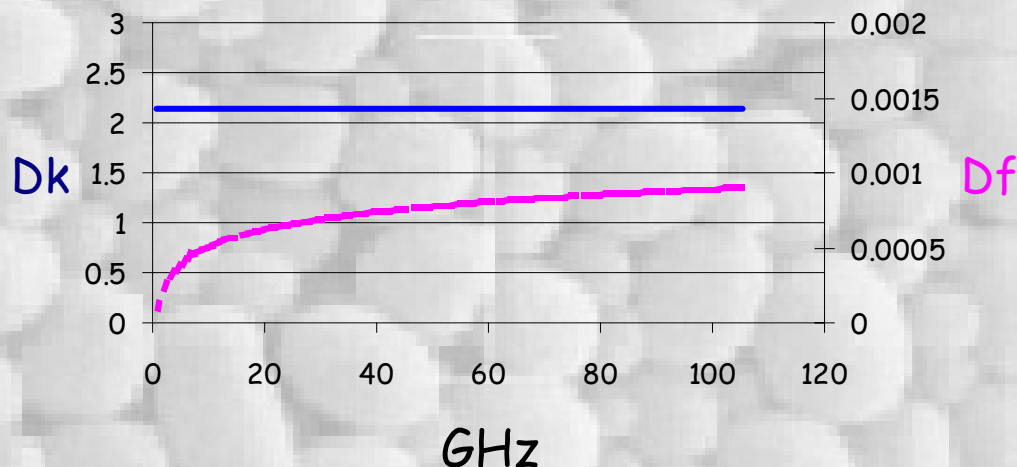
Taconic Advanced Dielectric Division

TACONIC

Why PTFE?

As a PCB substrate:

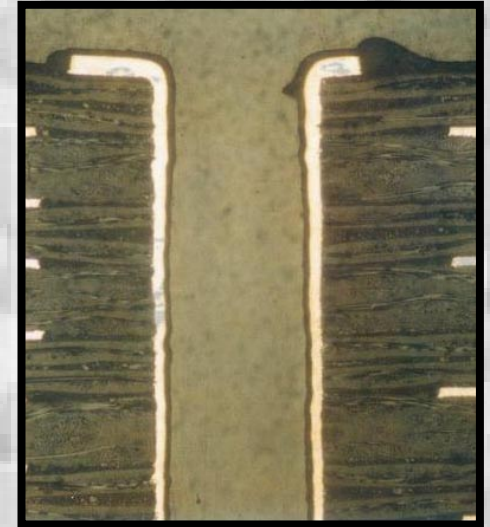
- Lowest loss
- Best dielectric consistency
- Lowest moisture absorption; 0.02%
- Best copper adhesion (like FR4)



Why PTFE?

As a PCB substrate:

- Temperature stable (UL MOT 180C)
- Thermal-cycling reliability
- Excellent chemical resistance



Hot Temperature	125°C
Cold Temperature	-35°C
Dwell at Temperature Extremes	10 minute
Transfer Time	15 seconds
Number of Cycles	400

Automotive Design Activity (PTFE PCB):

- Collision avoidance radar
- Near-distance radar
- Tyre-pressure sensor
- Satellite radio antenna
- Engine management sensor
- Other sensor

RF/MW Low-loss

Temperature/Chemical resistance

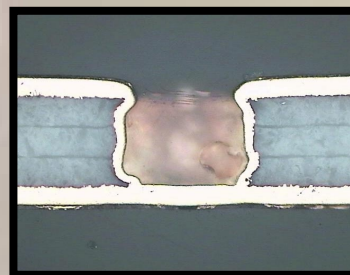
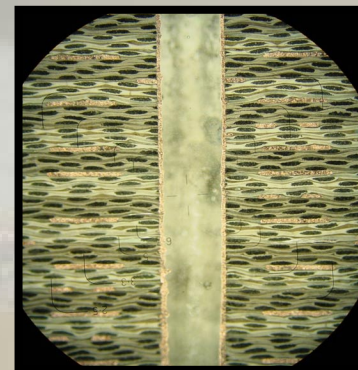
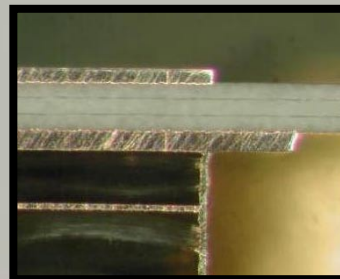
PTFE PCB Processing

- Established in US and Europe
- 3 of top 5 European PCB processors have volume PTFE capability
- Volume manufacture in Asia (China) growing - driven by telecom's & domestic-satellite-receiver LNB requirements
- >100,000m² processed annually
- Typical 24" x 18" panel processing

PTFE Opportunities

- Hybrid multilayer PCB; use of thin-cored PTFE substrates (RF/MW) combined in multilayer package with lower-cost FR4 (DC control).
- Use of thin -cored *or* unsupported PTFE (Taclamplus) for hybrid multilayer PCB's. As demonstrated in recent PROKOSMOS project.
- Use of laser machining technology
- PTFE Multilayer; Taconic Tacpreg™ enabling MLB formation:

Eg. 6 lyr, 3 x RF-35 + 2 x TP-32 P/Preg
= ~ \$0.58 - \$0.85/sq.in finished PCB



Taconic Laminated PTFE Materials

- Manufacturing:
 - Petersburg, USA
 - Mullingar, Ireland
 - Cheonan, Korea (coated fabric)
- Overview of Products:

Taconic Grade	Dk	Df @ 20GHz	Min. Thickness
Taclamplus	2.1	0.0007	0.025mm
TLY	2.2	0.0011	0.13mm
TLX	2.5	0.0025	0.13mm
TLE	2.95	0.0038	0.038mm
TLC	3.2	0.0040	0.50mm
Orcer TM RF-35	3.5	0.0050	0.05mm
Orcer TM RF-60	6.15	0.0032	0.63mm
Orcer TM Cer-10	10	0.0037	0.63mm

In Summary

- LAMINATES: PTFE/glass laminates for PCB are manufactured in volume using mature technology
- PCB Capability: Existing w/w volume manufacture
- Multilayer: PTFE substrates can be "mulilayered" and are compatible with laser-machining technology