



DUPONT THICK FILM MATERIAL SYSTEM FOR AlN SUBSTRATES



A full line of thick film materials for AlN substrates

COOL YOUR CIRCUITS TO THE CORE

Next generation electronic packaging requires excellent thermal stability and heat dissipation to achieve maximum performance. High frequency and high power applications, combined with higher density interconnects, demand the use of materials that provide adequate thermal management within the circuit.

A new, complete system of thick film materials specifically designed for aluminum nitride (AlN) substrates is commercially available from DuPont.

Now, designers can take advantage of the benefits of AlN substrates for applications requiring high thermal dissipation—at a much lower cost than traditional thin film metallization AlN systems.

FEATURES

- Complete gold and silver-based systems
- Excellent heat dissipation properties
- Cost-effective, high-volume capabilities
- Demonstrated reliability in harsh environments
- Consistent performance

TYPICAL APPLICATIONS

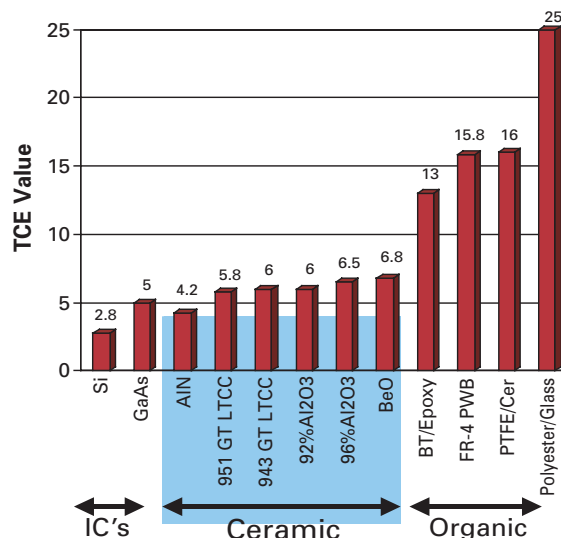
- Automotive
- Telecommunication systems
- Optoelectronics
- Military
- Alternative to beryllium oxide (BeO) applications

EXCELLENT THERMAL PERFORMANCE

Ceramic substrates have many times the thermal conductivity of organic PWB materials. Better heat dissipation simplifies thermal design and significantly improves circuit life and reliability. Additionally, aluminum nitride substrates have long been known to be safer to handle than BeO.

Thick printed (150 μm) silver compositions are a cost-effective alternative to direct bond copper due to less complicated processing.

A patented reaction bond system is designed to reduce gassing and blistering that is common with AlN substrates, resulting in excellent aged adhesion (1000 hr/150°C > 20 N) and better appearance. The system is designed to be more flexible with accommodating the coefficient of thermal expansion (TCE) mismatch.



TCE of AlN is well-matched to Si and GaAs

Source: Tummala, ASM Handbook, DuPont Data

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MECHANICAL PROPERTIES COMPARISON

Table 1

Property	AlN	BeO	Al ₂ O ₃
Dielectric Constant	8.9	6.7	9.8
Dielectric Loss	0.0001	0.0003	0.0002
Resistivity (Ohm-cm)	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴
Thermal Cond. (W/mK)	170-200	260	36
CTE (ppm/C)	4.6	8.5	8.2
Density (g/cm ³)	3.30	3.85	2.89
Bending Strength (mPa)	290	230	380
Hardness (GPa)	11.8	9.8	14.1
Young's Mod (GPa)	331	345	372

COMPLETE THICK FILM MATERIAL SYSTEM

DuPont offers a complete system of thick film materials designed to take advantage of the excellent thermal properties of AlN (see Table 2). The thick film material performance is consistent across different substrates from major vendors.

Additional technical information is available in the AlN Material System Selector Guide.

Table 2. Thick Film Materials for Aluminum Nitride

AlN Conductors and Dielectric						
Product	AlN44	AlN11	AlN21	AlN23	AlN33	AlN71
Chemistry	Diel	Ag	Ag/Pt 100:1	Ag/Pt 3:1	Ag/Pd 10:1	Au
Solderable						
62/36/2	N/A	X	X	X	X	N/A
10/88/2	N/A	X	X	X	X	N/A
Plateable	N/A	X	X	NT	X	N/A
Brazable	N/A	X	X	NT	X	No
Wirebondable						
Au	N/A	X	X	N/A	NT	X
Al	N/A	NR	NR	NR	NT	X



DUPONT THICK FILM MATERIAL SYSTEM FOR AIN SUBSTRATES

FOR MORE INFORMATION ON DUPONT THICK FILM MATERIAL SYSTEM FOR AIN SUBSTRATES OR OTHER DUPONT MICROCIRCUIT MATERIALS, PLEASE CONTACT YOUR LOCAL REPRESENTATIVE:

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