SD-2 – Glass Substrate for Silicon Sensors

HOYA's SD-2 substrate is designed with a coefficient of thermal expansion curve which closely matches Si single crystal.

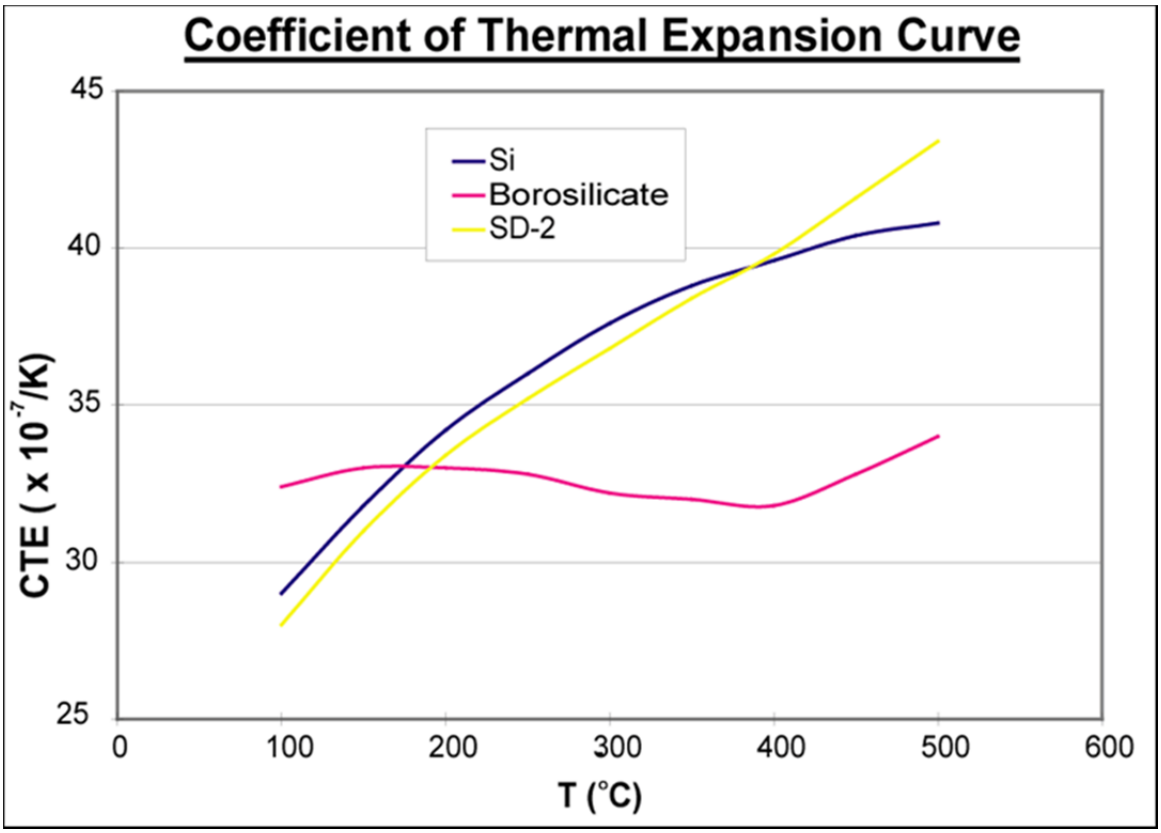
Thermal Expansion Properties

Borosilicate glass has been widely used as a bonding material to Silicon Wafer. CTE curves of Borosilicate glass and Silicon Single Crystal Wafer cross at about 240°C. When anodic bonding is performed at 400°C, the difference of the expansions at high temperature creates residual stress in the Si chip during cooling to room temperature. As precision of LSI circuit patterning moves to less than 0.25 microns, distortion between the silicon and glass wafers becomes a critical issue.

HOYA's SD-2 substrate is engineered to minimize the distortion or bowing effect caused by the thermal miss-match between the two wafers.

Anodic Bonding

Silicon and glass wafers are generally put together by way of Anodic Bonding. This bonding is formed when positive (+) DC voltage is applied to the Si wafer and negative (-) is applied to the glass wafer while the wafers are pressed and heated. During the bonding process, a small amount of Na^+ ions, engineered into SD-2, move as electro conductive carriers to facilitate a very short bonding time.



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SD-2 – Glass Substrate for Silicon Sensors

Thermal Properties	SD-2	Borosilicate
Coefficient of Thermal Expansion	32.0×10^{-7}/°C	32.5×10^{-7}/°C
Transformation Point (T_g)	721°C	552°C
Sag Point (T_s)	787°C	
Strain Point	669°C	510°C
Annealing Point	720°C	560°C
Thermal Conductivity	0.0026 Cal/sec•cm•°C	0.0027 Cal/sec•cm•°C
Specific Heat	0.176 Cal/g•°C	0.180 Cal/g•°C
Mechanical Properties		
Specific Gravity	2.6	2.23
Young's Modulus	8860 kgf/mm^2	6400 kgf/mm^2
Modulus of Rigidity	3560 kgf/mm^2	
Poisson's Ratio	0.244	0.2
Knoop Hardness	638 kgf/mm^2	418 kgf/mm^2
Electrical Properties		
Volume Resisitivity (DC500V) 20°C	4.1×10^{14} Ω•cm	1.4×10^{16} Ω•cm
Volume Resisitivity (DC500V) 100°C	4.2×10^{11} Ω•cm	4.6×10^{11} Ω•cm
Volume Resisitivity (DC500V) 200°C	3.8×10^{9} Ω•cm	0.9×10^{9} Ω•cm
Dielectric Coefficient (1MHz) 20°C	6	4.8
Dielectric Coefficient (1MHz) 100°C	7	4.9
Dielectric Coefficient (1MHz) 200°C	7	5.1
Dielectric Loss (1MHz) 20°C	1.0×10^{-2}	5.5×10^{-3}
Dielectric Loss (1MHz) 100°C	1.9×10^{-2}	1.0×10^{-2}
Dielectric Loss (1MHz) 200°C	4.9×10^{-2}	2.9×10^{-2}
Chemical Properties		
Acid Durability (30% HNO_3 80°C 50H)	1.20 mg/cm^2 loss	0.50 mg/cm^2 loss
Alkaline Durability (0.01N NaOH 50°C 15H)	0.01 mg/cm^2 loss	0.02 mg/cm^2 loss
Optical Properties		
Refractive Index (n_d)	1.531	1.474
Abbe-Number (ν_d)	59	

Note: The listed data are standard values. Because of continuous product improvement, the various data listed are subject to change without notice.

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