

3M Advanced Materials Division

3M™ Silicon Carbide Material Platform

Typical Material Properties

(Not for specification purposes)

| Property | Standard | Symbol/Unit | Grade F | Grade F Plus | Grade C | Grade P | Grade G | Grade T Plus |
|---|--------------|----------------------------------|------------------|------------------|-----------------------------------|------------------|-----------------------------------|-----------------------------------|
| Density | DIN EN 623-2 | ρ (g / cm ³) | >3.15 | >3.18 | >3.15 | 2.76 – 2.89 | >3.10 | >3.24 |
| Porosity | DIN EN 623-2 | P (%) | <2.0 | <1.0 | <2.0 | 10 – 14 | <2.0 | <1.0 |
| Mean Grain Size | | μm | <5 | <5 | Bimodal | <5 | Bimodal | <2 |
| Grain Size Distribution | | μm | | | 10 – 1500 | | 10 – 1000 | |
| Phase Composition | | | α - SiC | α - SiC | α - SiC | α - SiC | α - SiC, Graphite | α - SiC, YAG |
| Vickers Hardness | DIN EN 843-4 | HV1 (GPa) | 24.5 | 24.5 | 24.5 | 24.5 | 24.5 | 22.5 |
| Knoop Hardness | DIN EN 843-4 | HK 0.1 (GPa) | 24.5 | 24.5 | 24.5 | 24.0 | 24.0 | 22.5 |
| Young's Modulus | DIN EN 843-2 | E (GPa) | 430 | 430 | 430 | 340 | 390 | 430 |
| Weibull Modulus | DIN EN 843-5 | m | 10 | 10 | 10 | 15 | 15 | 15 |
| Flexural Strength, 4-pt bending | DIN EN 843-1 | σ_b (MPa) | 400 | 510 | 400 | 225 | 250 | 650 |
| Compressive Strength | DIN 51104 | σ_c (MPa) | >2500 | >2500 | >2500 | >2000 | >2200 | >2500 |
| Poisson Ratio | DIN EN 843-2 | ν | 0.17 | 0.17 | 0.17 | 0.13 | 0.15 | 0.17 |
| Fracture Toughness (SENB) | | K_{Ic} (MPa·m ^{0.5}) | 4 | 4 | 4 | 3 | 3.5 | 6 |
| Coefficient of Thermal Expansion | | | | | | | | |
| 25 – 500 °C | DIN EN 821-1 | α (10 ⁻⁶ /K) | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 4.1 |
| 500 – 1000°C | DIN EN 821-1 | α (10 ⁻⁶ /K) | 5.1 | 5.1 | 5.1 | 5.1 | 5.1 | 5.3 |
| Specific Heat at 25°C | DIN EN 821-3 | c_p (J/g K) | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.71 |
| Thermal Conductivity at 25°C | DIN EN 821-2 | λ (W/m K) | 130 | 130 | 130 | 110 | 130 | 87 |
| Thermal Stress Parameters | | | | | | | | |
| $R_1 = \sigma_b \cdot (1 - \nu) / (\alpha \cdot E)$ | Calculated | R_1 (K) | 203 | 259 | 203 | 152 | 143 | 306 |
| $R_2 = R_1 \cdot \lambda$ | Calculated | R_2 (W/mm) | 26 | 34 | 26 | 17 | 19 | 27 |
| Specific Electrical Resistance at 25°C | DIN EN 50359 | ρ (Ω cm) | >10 ⁸ | >10 ⁸ | 10 ⁴ – 10 ⁵ | >10 ⁸ | 10 ⁴ – 10 ⁵ | 10 ³ – 10 ⁵ |

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3M Technical Ceramics

Zweigniederlassung der 3M
Deutschland GmbH Max-Schaidhauf-
Str. 25, 87437 Kempten, Germany

Phone +49 (0)831 5618-0
Web www.3M.de/Technical-Ceramics

3M Advanced Materials Division

3M Center
St. Paul, MN 55144 USA

Phone 1-800-367-8905
Web www.3M.com/advancedmaterials

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