



## General properties of diamond

| <u>Property</u>                          | <u>Value</u>                        | <u>Units</u>            |
|--|-------------------------------------|-------------------------|
| Hardness                                 | 10,000                              | kg/mm <sup>2</sup>      |
| Strength, tensile                        | >1.2                                | Gpa                     |
| Strength, compressive                    | >110                                | Gpa                     |
| Fracture strength                        | 400–800                             | MPa at < 1 mm thickness |
| Sound velocity                           | 18,000                              | m/sec                   |
| Density                                  | 3.52                                | g/cm <sup>3</sup>       |
| Young's modulus                          | 1200                                | GPa                     |
| Poisson's ratio                          | 0.2                                 | Dimensionless           |
| Atomic density                           | 1.77 x 10 <sup>23</sup>             | atoms/cm <sup>3</sup>   |
| Thermal expansion coefficient            | 1.1–5.0 (300-1300K)                 | ppm/K                   |
| Thermal conductivity                     | 10–20                               | W/cm-K                  |
| Thermal shock parameter                  | 30,000,000                          | W/m                     |
| Coefficient of friction                  | 0.05 (dry)                          | Dimensionless           |
| Derbye temperature                       | 2,200                               | K                       |
| Optical index of refraction (at (591 nm) | 2.41                                | Dimensionless           |
| Optical transmissivity range             | 225 to far IR                       | nm                      |
| Emissivity                               | 0.02–0.03                           | at 10 microns           |
| Optical absorption coefficient           | 0.05–0.3                            | at 10 microns           |
| Loss tangent at 40 Hz                    | 0.0006                              | Dimensionless           |
| Loss tangent at 140 GHz                  | <10 <sup>-5</sup>                   | Dimensionless           |
| Dielectric constant                      | 5.7                                 | Dimensionless           |
| Dielectric strength                      | 10,000,000                          | V/cm                    |
| Electron mobility                        | 2,200                               | cm <sup>2</sup> /V-sec  |
| Hole mobility                            | 1,600                               | cm <sup>2</sup> /V-sec  |
| Electron saturated velocity              | 27,000,000                          | cm/sec                  |
| Hole saturated velocity                  | 10,000,000                          | cm/sec                  |
| Work function                            | small and negative                  | On [111] surface        |
| Bandgap                                  | 5.45                                | eV                      |
| Resistivity                              | 10 <sup>13</sup> - 10 <sup>16</sup> | Ohm-cm                  |

## Thermal properties of diamond and other electronic materials

| <u>Material</u>  | <u>Thermal conductivity</u> | <u>Thermal expansion coefficient</u> |
|------------------|-----------------------------|--------------------------------------|
|                  | <u>W/cm/°K</u>              | <u>x 10<sup>-6</sup>/°K</u>          |
| CVD diamond      | 10–18                       | 1.5                                  |
| Silver           | 4.1                         | 19                                   |
| Copper           | 3.9                         | 17                                   |
| Beryllia         | 2.5                         | 6.4                                  |
| CuW/90/10        | 1.7                         | 6.5                                  |
| Aluminum nitride | 1.7                         | 4.6                                  |
| Alumina          | 0.25                        | 8                                    |
| Silicon          | 1.5                         | 4.1                                  |
| GaAs             | 0.44                        | 6.5                                  |