

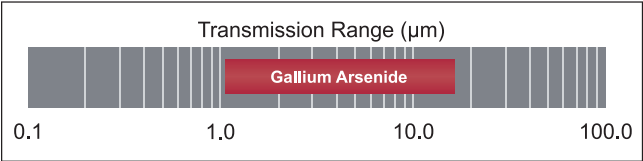
Gallium Arsenide, GaAs

Gallium Arsenide	
Crystallographic Properties	
Property	Value
Syngony	Cubic
Symmetry Class	F43m
Lattice Constants	a = 5.653
Cleavability	(111), Perfect

Mechanical Properties	
Property	Value
Density, ρ	5.317 g/cm ³
Knoop Hardness	721.0 kg/mm ²
Poisson's Ratio, ν	0.24
Young's Modulus, E	116.0 GPa
Shear Modulus, G	46.6 GPa
Solubility	0.005 (25) g/100g H ₂ O (°C)

Thermal Properties	
Property	Value
Thermal Linear Expansion, α	5.0 × 10 ⁻⁶ /K
Thermal Conductivity, k	54.0 W/(m•K)
Specific Heat Capacity, C_p	0.345 J/(g•K)
Melting Point, T_m	1,238 °C

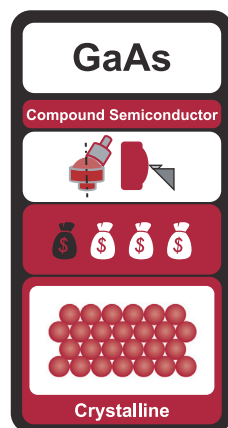
Optical Properties	
Property	Value
Refractive Index	3.3281 @ 3.6 μ m (RT)
Refractive Index	3.2919 @ 10.6 μ m (RT)
Absorption Coefficient, A	3.00E-02 cm ⁻¹ at 10.6 μ m
dn/dT	200.0 (10 ⁻⁶ /°C) at 10.6 μ m
Transmission Range	1–15 μ m



Gallium Arsenide, GaAs (cont.)

Gallium arsenide (GaAs) is a III-V compound **semiconductor**. It is grown by either the **liquid-encapsulated Czochralski** (LEC) method or the vertical gradient freeze (VGF) growth method. GaAs is available in **monocrystalline** or **polycrystalline** forms. It is available undoped as a semi-insulating material and doped with zinc, silicon, chromium, or tellurium as a semiconducting material in both p-type and n-type.

GaAs possesses low absorption from 2.5 to 12 μm . It provides an alternative to ZnSe for high-power CO₂ lasers as lenses or mirrors. The material is nearly equal to Ge in **strength**, **hardness**, and **density** and is as easy to fabricate (diamond turn, grind, and polish). GaAs has superior thermal properties compared to CdTe.



- Transmits MWIR and LWIR
- High strength and hardness



- More expensive than Ge
- Size limited to $\varnothing 100$ mm

GaAs is more expensive than ZnSe and Ge. GaAs optical-grade material is in limited supply and is available only in the shape of flat, round blanks.

Size Limitation
< 100-mm diameter

Available Grade
Optical grade,
• usually Cr⁺ doped

Fabrication Method
Czochralski

Main Applications
• LWIR thermal imaging
• Medium- to high-power CO₂ lasers

Gallium Arsenide, GaAs (cont.)

