Gallium Arsenide (GaAs)

🔷 Key Properties of **Gallium Arsenide (GaAs)**

🌈 **Broad Infrared Transmission:** Excellent optical transmission from ~2 µm to ~17 µm, covering both the mid-wave (MWIR) and long-wave infrared (LWIR) regions.

🔍 **High Refractive Index:** ~3.3 @ 10 µm — allows compact optical designs and efficient infrared beam control.

🔥 **Superior Thermal Conductivity:** Efficient heat dissipation under high-power laser and thermal imaging conditions, ensuring reliable performance.

🧪 **Non-Hygroscopic & Chemically Stable:** Unlike ZnSe or CsI, GaAs does not absorb moisture and remains stable in humid or outdoor environments.

❄️ **Excellent Thermal and Mechanical Stability:** Maintains performance under varying temperatures and mechanical stress, ideal for industrial and defense optics.

⚙️ **Hard & Durable Semiconductor Material:** Mechanically robust with good polishability and resistance to surface degradation.

🔬 **Advanced Infrared Optical Material:** Widely used for IR windows, lenses, beam splitters, laser optics, spectroscopy, and semiconductor substrates.

🛠️ Applications of Gallium Arsenide (GaAs)

🌡️ **Infrared Windows and Lenses:** Widely used in thermal imaging cameras and IR systems operating in the 3–5 µm and 8–12 µm bands, thanks to its broad transmission range and environmental stability.

🧪 **FTIR Spectroscopy and Analytical Instruments:** GaAs provides excellent mid- to far-infrared transmission, making it ideal for use in spectroscopy cells, beamsplitters, and sample windows.

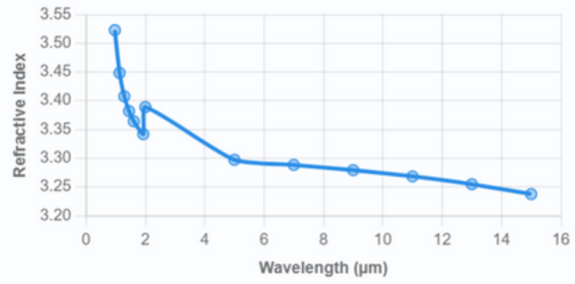
💡 **High-Power and CO_2 Laser Systems:** Its high refractive index and superior thermal conductivity make GaAs suitable for high-energy laser optics, beam combiners, and laser output couplers.

🚀 **Defense, Aerospace & Environmental Monitoring:** Non-hygroscopic and robust, GaAs is used in rugged IR sensor systems for airborne and terrestrial platforms.

🔬 **Semiconductor & Optoelectronic Devices:** GaAs is also a critical material in photodiodes, LEDs, and laser diodes, serving as both a substrate and active material.

⚙️ **Optical Fabrication & Coating Substrates:** Supplied as precision-polished blanks, GaAs is used for multilayer AR coatings tailored to MWIR and LWIR bands.

📈 Refractive Index of Gallium Arsenide (GaAs) vs. Wavelength

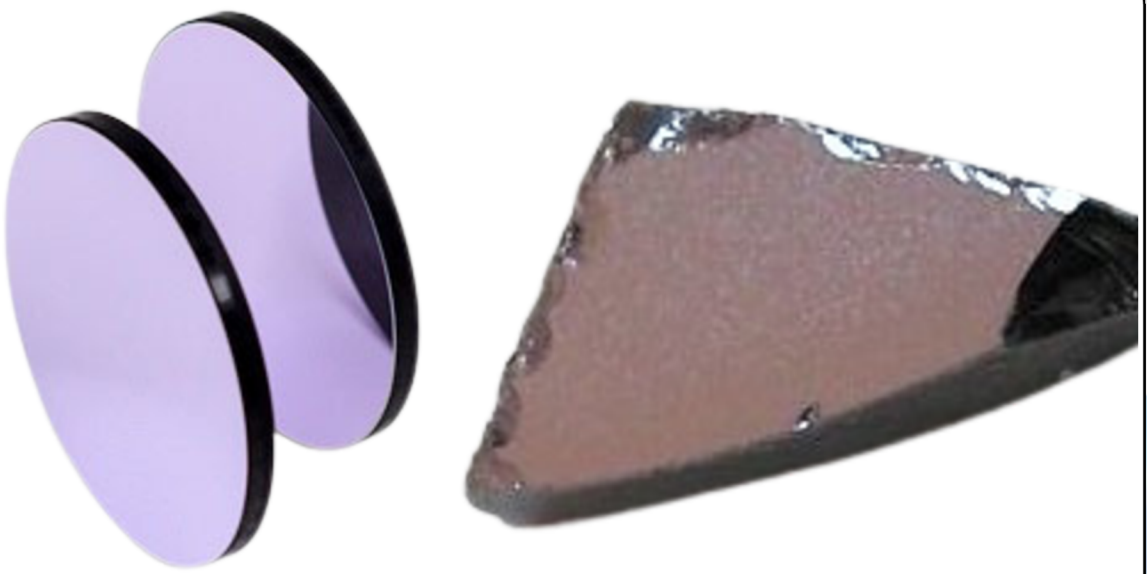


Real-world measurement data (CSV loaded dynamically)

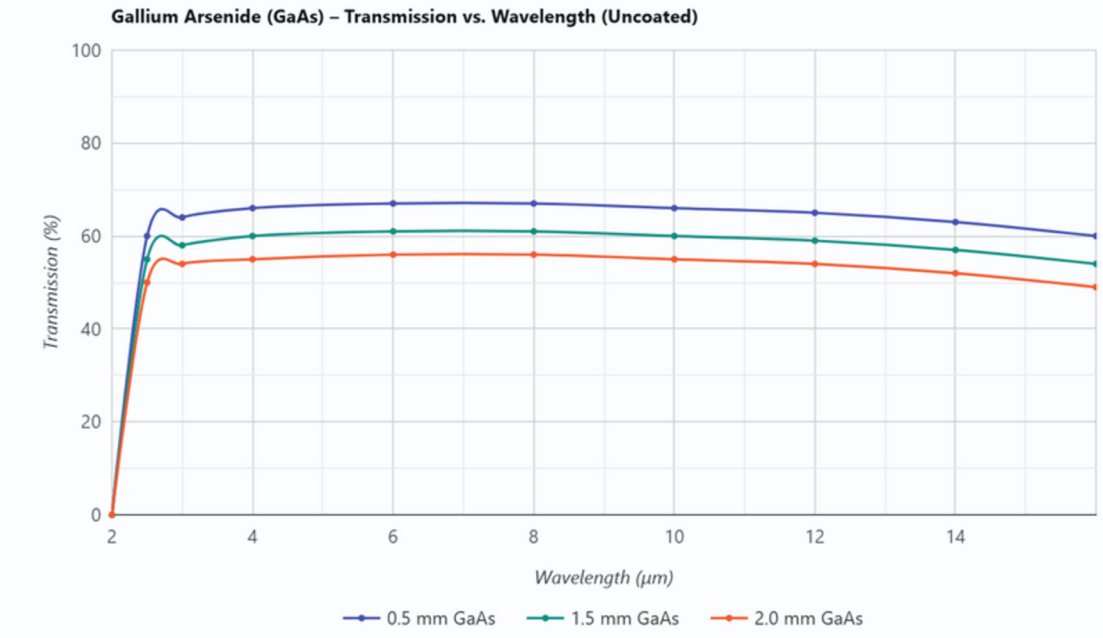
Wavelength	Refractive index
0.97	3.5227
1.13	3.4484
1.29	3.4076
1.45	3.3818
1.61	3.3641
1.93	3.3418
2.00	3.3889

Technical Parameters of Gallium Arsenide (GaAs)

Property	Typical Value
Transmission Range	~2 μm to 17 μm (mid-IR to far-IR)
Refractive Index	~3.3 @ 10 μm
Density	5.32 g/cm³
Hardness (Knoop)	~750 kg/mm²
Melting Point	~1238 °C
Thermal Expansion	~5.8 × 10^{-6}/°C @ 20–300 °C
Thermal Conductivity	~55 W/m·K
Crystal Structure	Cubic (Zincblende)
Hygroscopic	No — non-hygroscopic and moisture stable
Chemical Formula	GaAs
Laser Damage Threshold	>50 MW/cm² CW @ 10.6 μm (typical)
Applications	Infrared windows and lenses, FTIR spectroscopy, CO_2 laser optics, thermal imaging, aerospace, optoelectronics
Coating Compatibility	AR coatings for 3–5 μm & 8–12 μm, high-power laser coatings, MWIR/LWIR broadband AR



📊 Gallium Arsenide (GaAs) Transmission Graph



🌡️ Transmission range: 2 – 16 µm, based on typical uncoated GaAs curves .

📈 **0.5 mm, 1.5 mm, and 2.0 mm thicknesses compared — thinner samples transmit more in MWIR–LWIR bands.**