

GERMANIUM QUALITY SPECIFICATIONS FOR IR OPTICS

1. MECHANICAL PROPERTIES

Young Modulus	: 103 GPa
Shear Modulus	: 67.04 GPa
Bulk Modulus	: 77.86 GPa
Rupture Modulus, at 25°C	: ≥ 75 MPa
Knoop Hardness	: 8.3 GPa
Mohs Hardness	: 6.3
Poisson's Ratio, between 148°C...102°C	: 0.28
Density	: 5.33 g/cm ³

2. THERMAL PROPERTIES

Melting Point	: 937°C
Max working temperature (with coating)	: 90°C (above 90°C, transmission decreases and goes back to normal values when temperature decreases)
Boiling Point	: 2830°C
Specific Heat	: 0.074 cal/(g·°C) a 0-100°C
Linear Thermal expansion coefficient, at 27°C	: 6.1 × 10 ⁻⁶ °C ⁻¹
Thermal Conductivity, at 27°C	: 60 W/(m·°C)

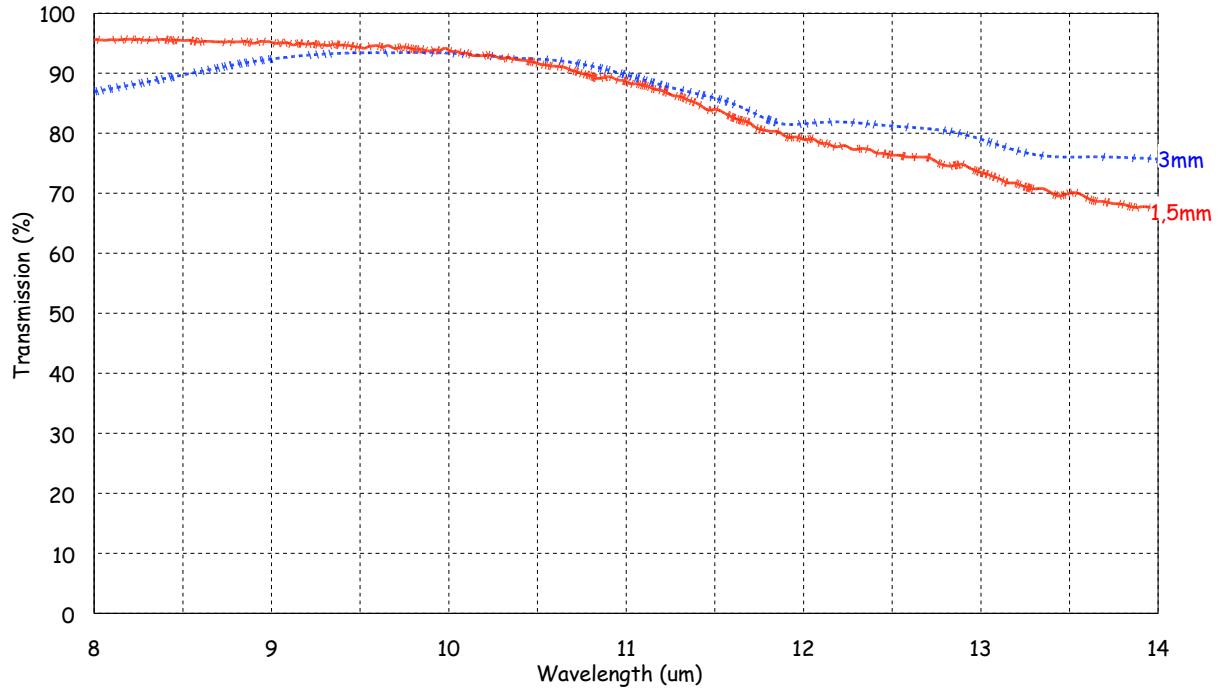
3. ELECTRICAL PROPERTIES

Dielectric constant	: 16
Resistivity, at 20°C	: 5-40 ohm-cm
Conductivity type	: N-type

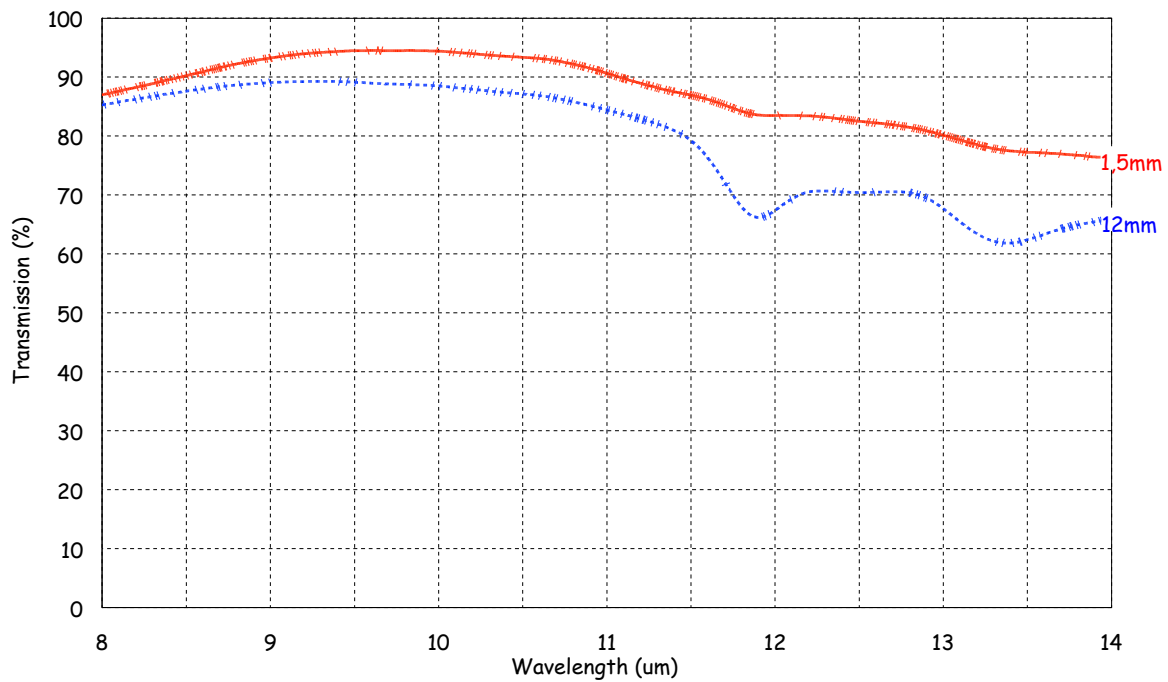
4. OPTICAL PROPERTIES

Trasmssion Range	: 1.8...23μm
Reafractive Index	: 4.0026 at 11μm
Variation of refractive index with temperature	: 0.0004 C ⁻¹ at 20°C...125°C

4.1 TRANSMISSION CURVE Ge with coating AR/AR @ 7,5...14µm



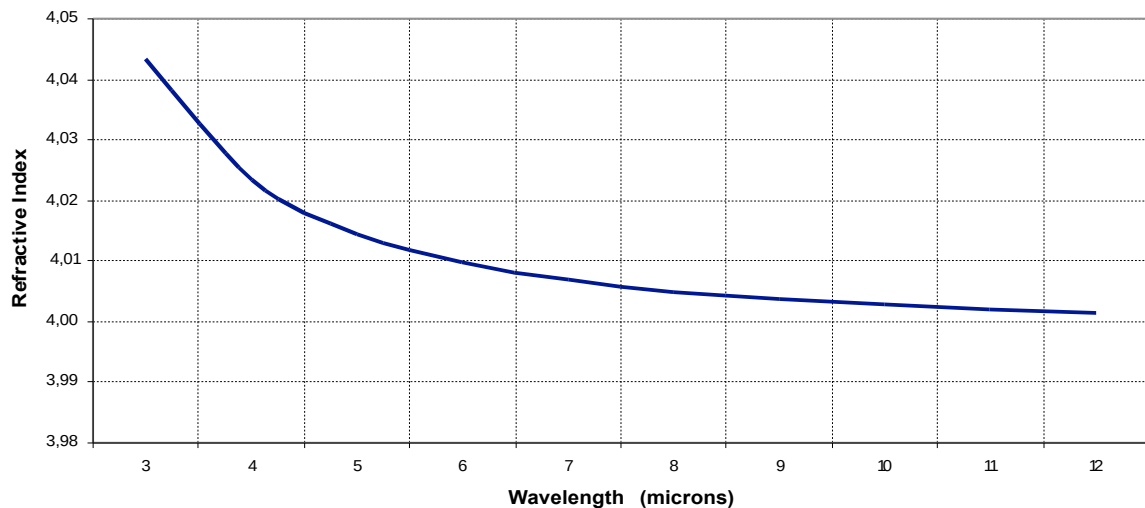
4.2 TRASMISSION CURVE Ge with coating AR/AR @ 7,5...14µm + 1 side Carbon Coating



4.2 The Refractive Index versus wavelength at 20°C

Wavelength (μm)	Refractive Index
3	4.04336
4	4.02341
5	4.01446
6	4.00971
7	4.00685
8	4.00501
9	4.00378
10	4.00277
11	4.00198
12	4.00142

The refractive index versus wavelength at 20°C



4.3 Typical Coefficient of Absorption at 20°C

Monocrystalline : $\leq 0.02 \text{ cm}^{-1}$

Polycrystalline : $\leq 0.02\text{-}0.035 \text{ cm}^{-1}$

5. STABILITY

Germanium is quite stable in air up to 400°C where slow oxidation begins.

6. RESISTIVITY

The metal resists concentrated hydrochloric acid and concentrated Sodium hydroxide solution, even at their boiling points. It is not attacked by cold sulphuric acid but does react slowly in hot sulphuric acid.

7. REACTIVITY

Germanium reacts readily with mixtures of nitric and hydrofluoric acid with molten alkalis and more slowly with aqua regia. Germanium also reacts readily with halogens to form the respective tetrahalides.