

Yttrium Iron Garnet

Product Description

Deltronic Crystal's single-crystal Yttrium Iron Garnet (YIG) is the most thoroughly characterized ferrimagnetic material available.

For Magneto-optical applications, magnetically saturated YIG rods rotate the polarization plane of light. Known as the Faraday effect, which is used in optical isolators.

For Microwave applications, YIG spheres high-Q resonance over a broad frequency range makes its use attractive in a variety of products including, magnetic resonance filters, tuned oscillators, and tuned band-reject and band-pass filters.

Applications

- Optical Isolators
- Multiplexers
- Tuned Oscillators
- Band-reject Filters
- Optical Switches
- Magnetic-field Sensors
- Fiberoptic Sensors

Features

- Low Temperature Dependence of Faraday Rotation
- Highly Transparent from 1.2 - 5mm
- High Q for Microwave Applications
- Grown by Flux Technique
- Superior Properties for both Optical and Microwave Applications

Figure 1. Faraday Rotator in an Optical Isolator

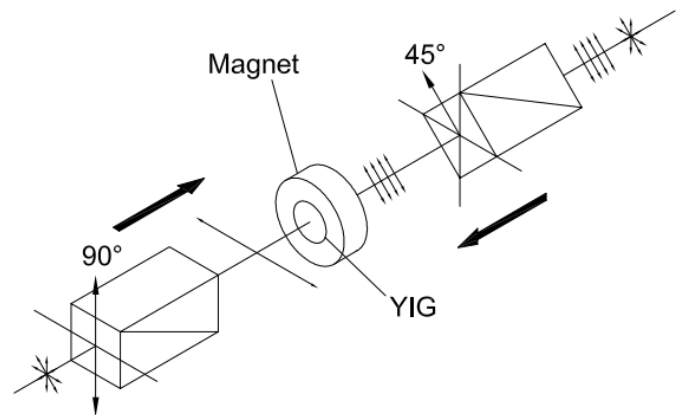
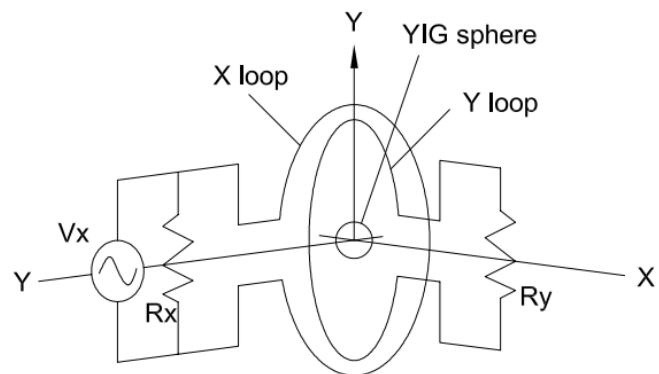


Figure 2. Magnetic Resonance Filter Concept



| Property at 25°C | Pure YIG | Ga:YIG |
|---|------------------------|-------------------------------|
| Empirical Formula | $Y_3Fe_5O_{12}$ | $Y_3Fe_{4.05}Ga_{0.95}O_{12}$ |
| Molecular Weight (grams) | 737.95 | 751.13 |
| Crystal Structure | Cubic | Cubic |
| Space Group | La3d | La3d |
| Density (g-cm ³) | 5.17 | 5.28 |
| Melting Point (oC) | 1555 | 1545 |
| Hardness (moh) | 6.5 to 7.0 | |
| Lattice Constant (Å) | 12.376 | 12.36 |
| Saturation Magnetization (Gauss) | 1780 | 400 |
| Ferrimagnetic Resonance Linewidth (Oe) | <0.30 | <0.95 |
| Magnetic Anisotropy (erg/cm ³) | -6.20×10^{-3} | -1.7×10^{-3} |
| Magnetic Anisotropy (erg/cm ³) | -0.05×10^{-3} | -6.20×10^{-3} |
| Effective g factor | 2 | 2 |
| Gyromagnetic ratio (MHz/Gauss ⁻¹) | 2.8 | 2.8 |
| Magnetostrictive Coefficient | -2.73×10^{-6} | -0.95×10^{-6} |
| Magnetostrictive Coefficient | -1.25×10^{-6} | -0.95×10^{-6} |
| Magnetostrictive Coefficient | -2.20×10^{-6} | |
| Electrical Resistivity (Ω/cm) | 1×10^{14} | |
| Young's Modulus | 2×10^{12} | 1×10^{12} |
| Poisson's Ratio | 0.29 | 0.25 |

| | | |
|--|-------|----|
| Dielectric Constant | 15 | 15 |
| Curie Temperature (K) | 553 | |
| Thermal Conductivity (W/cm ⁻¹ /°C ⁻¹) | 0.074 | |

| Property at 25°C | Pure YIG | Ga:YIG |
|---|-------------------------|---------------|
| Thermal Expansion Coefficient (°C ⁻¹) | 1.04 x 10 ⁻⁵ | |
| Refractive index, 1310 nm | 2.2 | |
| Refractive index, 1550 nm | 2.19 | |
| Specific Heat | 4.5 | |
| Optical Absorption, 1310 nm (cm ⁻¹) | 0.05 | 0.05 |
| Faraday Rotation, 1310 nm (°mm ⁻¹) | 21.4 | 14.5 |
| Transmittance1 (%) | >95 | >95 |
| Magneto-optical Sensitivity (°A ⁻¹) | 0.14 | 0.6 |

| Crystallographic Orientations, Dimensions, and Tolerances | |
|--|-------------------------------------|
| Standard Dimensions: | |
| Faraday Rotators | 2.1, 2.7mm length |
| Spheres | 1.8 to 5mm diameters 0.007" to 0.1" |
| Dimension Tolerances | ±0.005" length, ±0.002" diameter |
| Orientations | <100> |
| Flatness | <λ/5 at 633nm |
| Surface Quality | <10/5 (scratch/dig) |
| Parallelism, polished faces | <10 arc-minutes |
| Anti-reflective Coatings | Specify |
| Other Dopants | Specify |