

# 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

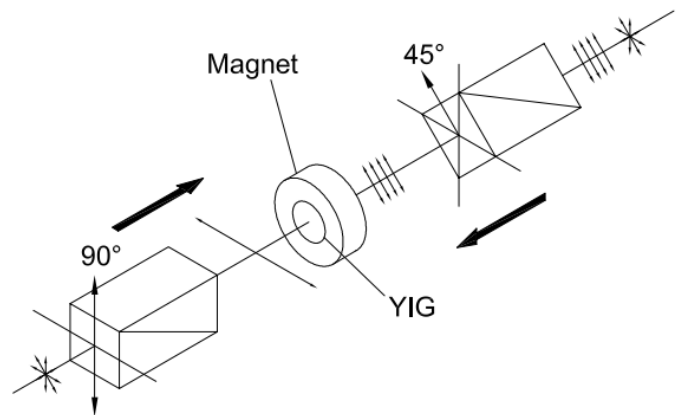
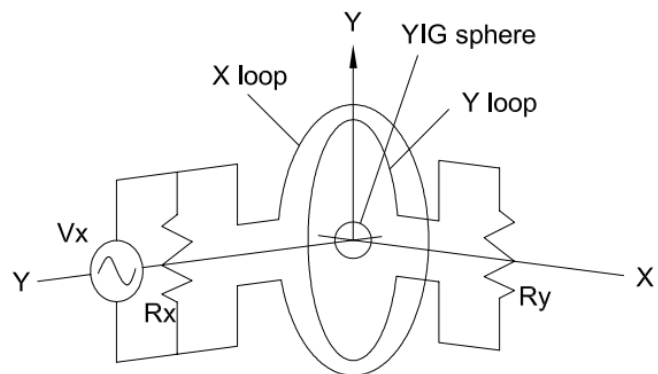


Figure 2. Magnetic Resonance Filter Concept



Property at 25°C	Pure YIG	Ga:YIG
Empirical Formula	$Y_3Fe_5O_{12}$	$Y_3Fe_{4.05}Ga_{.95}O_{12}$
Molecular Weight (grams)	737.95	751.13
Crystal Structure	Cubic	Cubic
Space Group	La3d	La3d
Density (g-cm <sup>3</sup> )	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 <sup>3</sup> )	$-6.20 \times 10^{-3}$	$-1.7 \times 10^{-3}$
Magnetic Anisotropy (erg/cm <sup>3</sup> )	$-0.05 \times 10^{-3}$	$-6.20 \times 10^{-3}$
Effective g factor	2	2
Gyromagnetic ratio (MHz/Gauss <sup>-1</sup> )	2.8	2.8
Magnetostrictive Coefficient	$-2.73 \times 10^{-6}$	$-0.95 \times 10^{-6}$
Magnetostrictive Coefficient	$-1.25 \times 10^{-6}$	$-0.95 \times 10^{-6}$
Magnetostrictive Coefficient	$-2.20 \times 10^{-6}$	
Electrical Resistivity (Ω/cm)	$1 \times 10^{14}$	
Young's Modulus	$2 \times 10^{12}$	$1 \times 10^{12}$
Poisson's Ratio	0.29	0.25

Dielectric Constant	15	15
Curie Temperature (K)	553	
Thermal Conductivity (W/cm <sup>-1</sup> /°C <sup>-1</sup> )	0.074	

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

<b>Crystallographic Orientations, Dimensions, and Tolerances</b>	
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