

# Y T T R I U M I R O N G A R N E T



## DESCRIPTION

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

## 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

## APPLICATIONS

Optical Isolators

Multiplexers

Tuned Oscillators

Band-reject Filters

Optical Switches

Magnetic-field Sensors

Fiberoptic Sensors

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## DRAWINGS

Figure 1. Faraday Rotator in an Optical Isolator

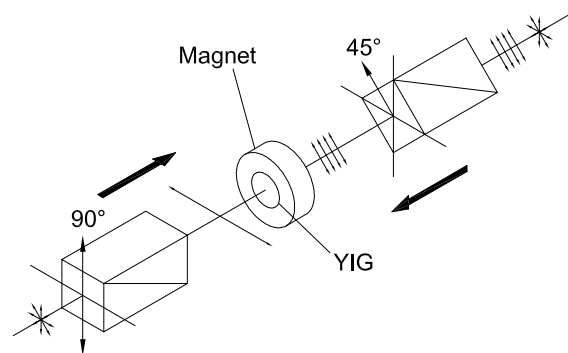
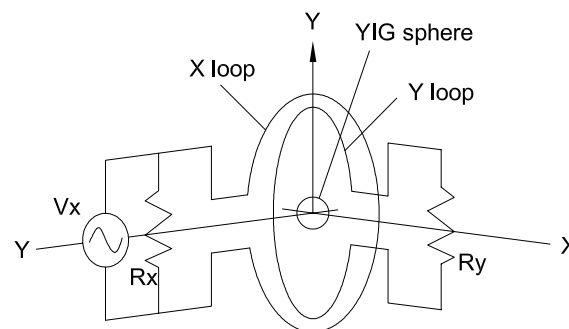


Figure 2. Magnetic Resonance Filter Concept



## PROPERTIES



**DELTRONIC**  
CRYSTAL INDUSTRIES, INC.

Property at 25° C	Pure YIG	Ga:YIG
Empirical Formula	Y <sub>3</sub> Fe <sub>5</sub> O <sub>12</sub>	Y <sub>3</sub> Fe <sub>4.05</sub> Ga <sub>0.95</sub> O <sub>12</sub>
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 (°C)	1555	1545
Hardness (moh)	6.5 to 7.0	
Lattice Constant (Å)	12.376	12.360
Saturation Magnetization (Gauss)	1780	400
Ferrimagnetic Resonance Linewidth (Oe)	<0.30	<0.95
Magnetic Anisotropy (erg/cm <sup>3</sup> )	-6.20 x 10 <sup>-3</sup>	-1.7 x 10 <sup>-3</sup>
Magnetic Anisotropy (erg/cm <sup>3</sup> )	-0.05 x 10 <sup>-3</sup>	-6.20 x 10 <sup>-3</sup>
Effective g factor	2	2
Gyromagnetic ratio (MHz/Gauss <sup>-1</sup> )	2.8	2.8
Magnetostrictive Coefficient	-2.73 x 10 <sup>-6</sup>	-0.95 x 10 <sup>-6</sup>
Magnetostrictive Coefficient	-1.25 x 10 <sup>-6</sup>	-0.95 x 10 <sup>-6</sup>
Magnetostrictive Coefficient	-2.20 x 10 <sup>-6</sup>	
Electrical Resistivity (U/cm)	1 x 10 <sup>14</sup>	
Young's Modulus	2 x 10 <sup>12</sup>	1 x 10 <sup>12</sup>
Poisson's Ratio	0.29	0.25
Dielectric Constant	15.0	15.0
Curie Temperature (K)	553	
Thermal Conductivity (W/cm <sup>-1</sup> /°C <sup>-1</sup> )	0.074	
Thermal Expansion Coefficient (°C <sup>-1</sup> )	1.04 x 10 <sup>-5</sup>	
Refractive index, 1310 nm	2.20	
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	0.60

## SPECIFICATIONS

Crystallographic Orientations, Dimensions, and Tolerances	
Standard Dimensions: Faraday Rotators Spheres	2.1, 2.7mm lengths; 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 μm (scratch/dig)
Parallelism, polished faces	<10 arc-minutes
Anti-reflective Coatings	Specify
Other Dopants	Specify

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