

# Co<sup>2+</sup>:Spinel - Passive Q-Switch

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Passive Q-switches or saturable absorbers generate high power laser pulses without the use of electro-optic Q-switches, thereby reducing the package size and eliminating a high voltage power supply. Co<sup>2+</sup>:Spinel (MgAl<sub>2</sub>O<sub>4</sub>) is the material of choice for the important eye-safe wavelengths near 1.5 microns. It has useful absorption that covers 1.2 to 1.6 micron laser transitions. Spinel is a hard, stable crystal that polishes well.

Cobalt substitutes readily for magnesium in the Spinel host without the need for additional charge compensation ions. A convenient measure of the Co<sup>2+</sup> concentration is the low power absorption coefficient  $\alpha$  at, for example, 1533 nm, a typical wavelength for Erbium phosphate glass. SYNOPTICS grows crystals for passive Q-switches with  $\alpha$  values from about 0.5 to 3 cm<sup>-1</sup>. The actual Co<sup>2+</sup> ion density N in the crystal can be calculated from  $N = \alpha / \frac{1}{2} \sigma_{\text{GSA}}$  where  $\frac{1}{2} \sigma_{\text{GSA}}$  is the ground-state absorption cross-section with a value<sup>1</sup> of 3.5 x 10<sup>-19</sup> cm<sup>2</sup>. This absorption is high enough to permit Q-switching of Erbium glass without intracavity focussing.

Passive Q-switches are typically specified by the low power Optical Density (or %T) at the laser wavelength. SYNOPTICS measures the  $\alpha$  value in the crystal and adjusts the part thickness to the optical density specified. Thickness is therefore a free parameter, but typically 1 - 5 mm.

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# Specifications

## SYNOPTICS Standard

Orientation:	<100>
Surfaces:	flat / flat
Coatings:	AR < 0.25% at 1533 nm
Damage Threshold:	> 500 MW / cm <sup>2</sup>

## Customer Values

Diameter :	typical: 5 - 10 mm
Optical Density: at 1064 nm	typical: 0.70, 0.80, 0.90

### **References**

1. K.V. Yumashev, Applied Optics **38**, No. 30 (1999) 6343-6346.

Specifications and information are subject to change without prior notice.  
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