

# Cr<sup>4+</sup>: YAG - Passive Q-Switch

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Passive Q-switches or saturable absorbers provide high power laser pulses without electro-optic Q-switches, thereby reducing the package size and eliminating a high voltage power supply. Cr<sup>4+</sup>:YAG is more robust than dyes or color centers and is the material of choice for 1 micron Nd lasers.

A small fraction of the chromium ions in YAG can be induced to change valence from the normal Cr<sup>3+</sup> to Cr<sup>4+</sup> with the addition of charge compensating impurities such as Mg<sup>2+</sup> or Ca<sup>2+</sup>. The convenient measure of the Cr<sup>4+</sup> concentration is the low power absorption coefficient  $\alpha$  at 1064 nm. Typical  $\alpha$  values vary from about 1.5 cm<sup>-1</sup> for tunable laser crystals to 3 - 6 cm<sup>-1</sup> for passive Q-switches. The actual Cr<sup>4+</sup> ion density N in the crystal can be calculated from  $N = \alpha / \frac{1}{2} \sigma_A$  where  $\frac{1}{2} \sigma_A$  is the absorption cross-section with a value<sup>1</sup> of  $5 \times 10^{-18}$  cm<sup>2</sup>.

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 Cr<sup>4+</sup>:YAG boule and adjusts the part thickness to the optical density specified. Thickness is a free parameter, but typically 1 - 5 mm.

## Specifications

SYNOPTICS Standards	Orientation:	< 100 >
	Surfaces:	flat / flat
	Coatings:	AR < 0.2% at 1064 nm
	Damage Threshold:	> 500 MW / cm <sup>2</sup>
Customer Values	Diameter:	typical: 5 - 10 mm
	Optical Density: at 1064 nm:	typical: 0.30, 0.40, 0.50, $\pm 10\%$

### References

1. Review Article: A.G. Okhrimchuk and A.V. Shestakov, Optical Materials 3 (1994) pp.1-13.

Specifications and information are subject to change without prior notice.  
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