



# Laser Crystals

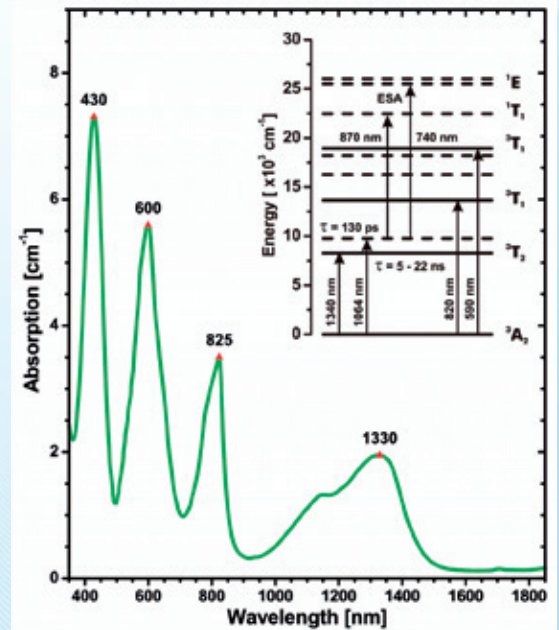
## Passive Q-switches

### V:YAG Saturable Absorber

YAG crystals doped with three-valent vanadium  $V^{3+}$  in tetrahedral positions hint at being efficient passive absorbers for lasers operating in the 1.3  $\mu\text{m}$  region. Efficient Q-switching and modelocking has been obtained with a number of active media such as Nd:YAG, Nd:YAP, Nd:KGW, Nd:YVO<sub>4</sub> under flash-lamp and diode pumping.

#### V:YAG properties at 1.3 $\mu\text{m}$

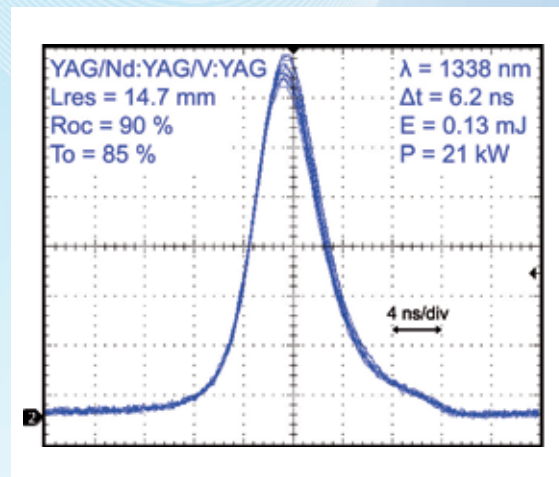
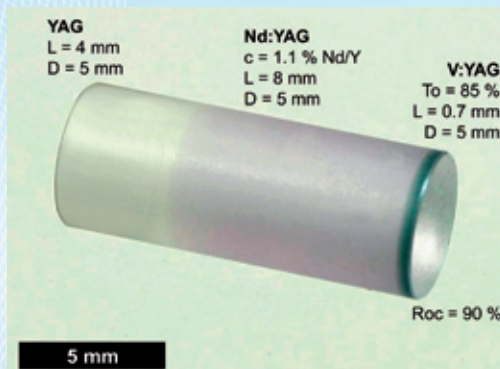
Ground-state absorption cross-section	$7.2 \times 10^{-18} \text{ cm}^2$
Excited-state absorption cross-section	$7.4 \times 10^{-19} \text{ cm}^2$
Recovery time	5 - 22 ns
Absorption coefficient (standard $V^{3+}$ concentration)	$2.2 \text{ cm}^{-1}$



V:YAG plates are available in a wide range of initial transmission values and with diameters between 2 – 10 mm .

#### Application example:

**Q-switched  
Nd:YAG-V:YAG  
microchip laser**



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## Passive Q-switches



### Cr<sup>4+</sup>:YAG Saturable Absorber



Cr<sup>4+</sup>:YAG provides a large absorption cross section in the 0.9-1.2 micrometer spectral region, which makes it an attractive choice as a passive Q-switch for diode or lamp pumped Nd:YAG, Nd:YLF, Nd:YVO<sub>4</sub>, Yb:YAG lasers. Cr<sup>4+</sup>:YAG has a high damage threshold, good thermal conductivity, good chemical stability and is resistant to ultraviolet radiation.

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#### Cr<sup>4+</sup>:YAG specification

Formula	Cr <sup>4+</sup> :Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub>
Crystal structure	cubic <100>
Thermal conductivity	0.11 Wcm <sup>-1</sup> K <sup>-1</sup>
Thermal expansion	7.8 x 10 <sup>-6</sup> K <sup>-1</sup>
contrast $\gamma = \sigma_{gs} / \sigma_{es}$	8.1 +/- 20 %
Recovery time	8.5 $\mu$ s
Refractive index at 1064 nm	1.82

#### Standard design of Cr<sup>4+</sup>:YAG disc

Diameter	2 – 10 mm
Surface flatness	$\lambda/10$
Surface figure	S/D 10/5
End face parallelism	20 arc sec
AR coated (85 % of aperture)	R = 0.2 %
Partial and HR coating upon request	