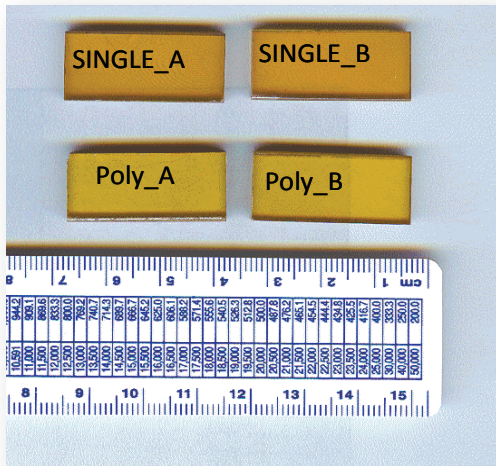


Fe²⁺:ZnSe and Fe²⁺:ZnS PASSIVE Q-SWITCHES

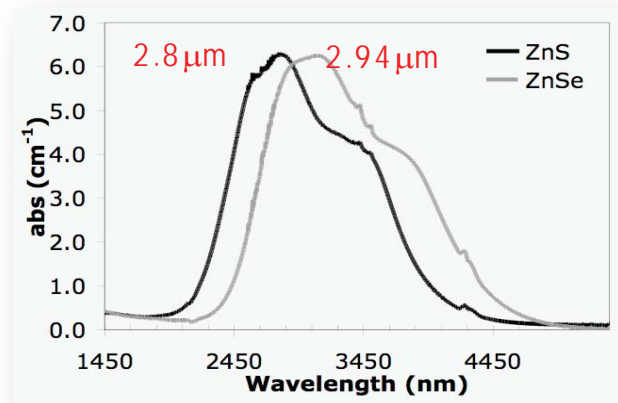
Fe²⁺:ZnSe and Fe²⁺:ZnS saturable absorbers (SA) are ideal materials for passive Q-switches of solid-state lasers operating in the spectral range of 2.5-4.0 μm .

These lasers (e.g. 3.0 μm Er:YAG/YSGG/YLF) are used for pumping middle-infrared Optical Parametric Oscillators and for numerous medical and dental applications.

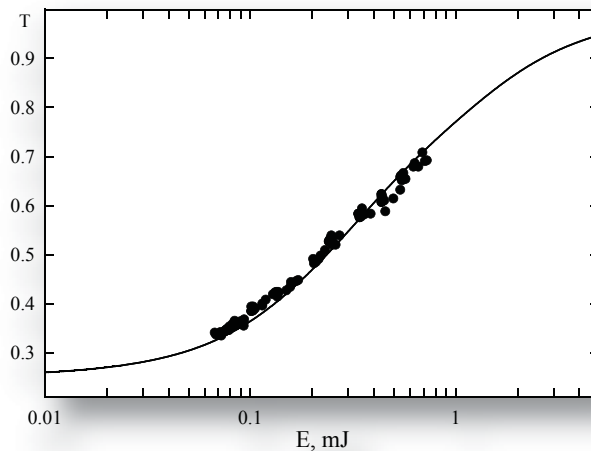
IPG's fabrication process allows low cost mass production of a very large variety of diffusion-doped Fe²⁺:ZnSe/ZnS crystals with low losses, uniform distribution of iron, good reproducibility and reliability.



Samples of Fe²⁺:ZnSe Single and Polycrystalline Saturable Absorbers



Absorption Spectra of Fe²⁺:ZnS & Fe²⁺:ZnSe Saturable Absorbers



Experimental Results for Transmission vs. Fluence in Fe:ZnSe (circles)
 Numerical fit for $\sigma_{\text{gsa}} = 0.6 \times 10^{-18} \text{ cm}^2$ at 2.8 μm (solid line)

Fe²⁺:ZnS and Fe²⁺:ZnS Passive Q-Switches

Crystal	Peak coefficient absorption, cm ⁻¹	Upper level lifetime at 300K, μs	σ _{gsa} at 2.8 μm, 10 ⁻²⁰ cm ²	σ _{gsa} /σ _{esa}	σ _{gsa} /σ _{YSGG}
Fe:ZnSe	1-20	0.37	90	0	30
Fe:ZnS	1-20	<0.3	130	0	43

According to the criterion for Saturable Absorber Q-switching:

$$\frac{\sigma_{Qgsa}}{\sigma_{YSGG}} \times \frac{A_{YSGG}}{A_Q} > 1$$

Fe:ZnSe/S can be used as a saturable absorber Q-switch for the Cr:Er:YSGG laser without intracavity focusing.

Output energies of 15 and 85 mJ were achieved in single and multipulse modes of operation, respectively.

The combination of

- high values of saturation cross-section,
- small saturation energy with good opto-mechanical (damage threshold – 2 J/cm²) and
- physical characteristics of ZnSe and ZnS hosts

makes Fe²⁺:ZnSe/S crystals an ideal market for passive Q-switching of mid-infrared laser cavities.

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