CdSe OPO pumped by a 2.79-um Cr,Er:YSGG laser

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ACKNOWLEDGEMENTS

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US Army
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CdSe MATERIAL
Gary Catella, Michael Panfil and Lee Shiozawa
Cleveland Crystals, Inc.
Highland Heights, OH
BACKGROUND
  Why CdSe?
  Why Cr,Er:YSGG?

Cr,Er:YSGG LASER

CdSe OPO

SUMMARY

LOOKING AHEAD
Large, low-scatter crystals (10x10x50 mm)

Low absorption
<0.002 cm$^{-1}$ @ 1.06 um
<0.001 cm$^{-1}$ @ 2.79 um
<0.001 cm$^{-1}$ @ 10.6 um

Large non-linear coefficient
deff = 17 - 18 pm/V

Low walk-off

Good thermal conductivity

Near NCPM with 2.79-um pump
CdSe PHASE-MATCHING, 2.79-um PUMP

Data

Atmospheric windows

Angle (deg)

Signal Wavelength (um)

Idler Wavelength (um)
POWER THRESHOLD FIGURE OF MERIT

- AgGaSe, I
- AgGaSe, II
- CdSe, II
- ZnGeP2, I
- ZnGeP2, II

POWER THRESHOLD (MW) vs SIGNAL (um)
EARLY RESULTS
25 mJ, 2 Hz, 50 ns, TEMoo
90 mJ, 2 Hz, 80 ns, multimode

GENERAL CHARACTERISTICS
1% Cr, 30% Er
+ low threshold
+ high PRF
+ 2.79 um operation
- thermo-optics properties
<table>
<thead>
<tr>
<th>PUMP CHAMBER COMPARISON</th>
<th>Pump Uniformity</th>
<th>Thermal lens focal length (cm)</th>
<th>Lens Astigmatism (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close-coupled silver</td>
<td>poor</td>
<td>32, 24</td>
<td>8</td>
</tr>
<tr>
<td>Racetrack spectralon</td>
<td>fair</td>
<td>38, 36</td>
<td>2</td>
</tr>
<tr>
<td>Elliptical silver</td>
<td>excellent</td>
<td>23, 15</td>
<td>8</td>
</tr>
</tbody>
</table>
2.79-μm Cr,Er:YSGG OSCILLATOR

OUTPUT:
25 mJ, 10 Hz, 35 ns
M2 = 2.8 x 1.4
Linear polarization

LiNbO₃ Q-Switch
75 cmcx HR
5 x 75 mm
75 cmcx HR
10 mcc HR
Flat 60 %R

75 cmcx HR
49°
Cr, Er:YSGG AMPLIFIER

Cr, Er:YSGG OSCILLATOR
25 mJ, 10 Hz
2.79 um

12 cmcx HR
@ 2.79um

5 x 75 mm AMPLIFIER

Si Plate

OUTPUT:
63 mJ, 10 Hz, 35 ns
Linear polarization
OUTPUT
15 mJ @ 3.87 um, 10 Hz, 23 ns
Signal tuning 3.58 - 4.18 um
28% pump-to-signal slope
Idler tuning 12.6 - 8.3 um
reasonably good beam quality
Cr,Er:YSGG OSCILLATOR
25 mJ, 10 Hz, 35 ns, 2.79 um
$M^2 = 2.8 \times 1.4$
Linearly Polarized

AMPLIFIER
83 mJ, 10 Hz, 35 ns
(63 mJ linearly polarized)

CdSe OPO
15 mJ, 10 Hz, 23 ns, 3.87 um
Tuning:
3.58 - 4.18 um (signal)
12.6 - 8.3 um (idler)
28% pump-to-signal slope efficiency
Better lamp-pumped materials

Pulsed, diode-pumped Er lasers
   2.4 mJ, 10 Hz, 9% slope (Dinerman, et al., ASSL '94)

Tandem OPO's