## PROCEEDINGS OF SPIE

# Solid State Lasers XXVII: Technology and Devices

W. Andrew Clarkson Ramesh K. Shori Editors

29 January – 1 February 2018 San Francisco, California, United States

Sponsored and Published by SPIE

Volume 10511

Proceedings of SPIE 0277-786X, V. 10511

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Solid State Lasers XXVII: Technology and Devices*, edited by W. Andrew Clarkson, Ramesh K. Shori, Proceedings of SPIE Vol. 10511 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

ISSN: 0277-786X ISSN: 1996-756X (electronic)

ISBN: 9781510615076 ISBN: 9781510615083 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)· Fax +1 360 647 1445 SPIE.org Copyright © 2018, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/18/\$18.00.

Printed in the United States of America Vm7 i ffUb 5ggc WUHY gz & Wži bXYf"]WY bgY Zfca GD-9.

Publication of record for individual papers is online in the SPIE Digital Library.



**Paper Numbering:** Proceedings of SPIE follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

### Contents

- vii Authors
- xi Conference Committee

#### EYE SAFE AND MID-IR LASERS I

- 10511 02 Efficient 2-µm Tm:YAP Q-switched and CW lasers [10511-1]
- 10511 06 Simulation of energy buildups in solid-state regenerative amplifiers for 2-μm emitting lasers [10511-5]
- 10511 07 **2.097µ Cth:YAG flashlamp pumped high energy high efficiency laser operation (patent pending)** [10511-6]

#### EYE SAFE AND MID-IR LASERS II

- 10511 09 Ultrashort pulse CPA-free Ho:YLF linear amplifier [10511-8]
- 10511 0A **Passive Q-switching of femtosecond-laser-written Tm:KLu(WO4)**<sup>2</sup> waveguide lasers by graphene and MoS<sub>2</sub> saturable absorbers [10511-9]
- 10511 0B **Tm:GdVO4 microchip laser Q-switched by a Sb2Te3 topological insulator** [10511-10]
- 10511 0E Advanced laser architectures for high power eyesafe illuminators [10511-12]

#### EYE SAFE AND MID-IR LASERS III

- 10511 0G Fiber-coupled three-micron pulsed laser source for CFRP laser treatment [10511-14]
- 10511 0H High efficiency compact mid-IR sources [10511-15]
- 10511 01 **Re-absorption and nonradiative energy transfer in vibronic laser gain media** [10511-16]
- 10511 0J High-energy diode side-pumped Er:YLF laser generating 100 mJ @ 100 Hz [10511-17]

#### DISK LASERS

- 10511 0K **kW picosecond thin-disk regenerative amplifier** [10511-18]
- 10511 OL New generation of compact high power disk lasers [10511-19]

10511 0N Generation of 1-J bursts with picosecond pulses from Perla B thin-disk laser system [10511-21]

#### PULSED LASERS I

10511 OP	Power balance on a multibeam laser [10511-23]
10511 OR	Sub-nanosecond lasers for cosmetics and dermatology [10511-25]
10511 OT	<b>100J-level nanosecond pulsed Yb:YAG cryo-cooled DPSSL amplifier (Invited Paper)</b> [10511-27]
	PULSED LASERS III
10511 OX	Characterization of Bivoj/DiPOLE 100: HiLASE 100-J/10-Hz diode pumped solid state laser [10511-33]
10511 OY	A developmental perspective on high power laser facility technology for ICF [10511-34]
10511 OZ	2-µm Cr <sup>2+</sup> : CdSe passively Q-switched laser [10511-35]
	UV-VIS LASERS
10511 12	Near-IR, blue, and UV generation by frequency conversion of a Tm:YAP laser [10511-38]
10511 13	Control of pulse duration and shape in a 400-W Q-switched 532-nm laser [10511-39]
	ULTRAFAST LASERS
10511 17	Low repetition rate operation of a femtosecond Yb:CALGO laser [10511-43]
10511 18	InP/InGaP quantum-dot SESAM mode-locked Alexandrite laser [10511-44]
10511 1B	High power green lasers for gamma source [10511-47]
10511 1C	Sub-100-attosecond residual timing jitter from turn-key diode-pumped solid state mode- locked ytterbium lasers [10511-48]
	AIRBORNE AND SPACE QUALIFIED LASERS
10511 1D	Laser system development for gravitational-wave interferometry in space [10511-49]
10511 1E	Progress on laser technology for proposed space-based sodium lidar [10511-50]

	NOVEL LASER CONCEPTS
10511 1H	Progress on Raman laser for sodium resonance fluorescence lidar [10511-53]
10511 1J	LED-pumped Alexandrite laser oscillator and amplifier [10511-55]
1051 1K	High-power single-pass pumped diamond Raman oscillator [10511-56]
10511 1M	Cylindrical vector beams through amplifiers [10511-58]
10511 1N	How to harvest efficient laser from solar light [10511-59]
	LASER MATERIAL AND CHARACTERIZATION
10511 10	Optical spectroscopy of cobalt-doped cadmium telluride [10511-60]
10511 1P	Growth of rare-earth doped single crystal yttrium aluminum garnet fibers [10511-61]
10511 1Q	Laser performance and modeling of RE <sup>3+</sup> :YAG double-clad crystalline fiber waveguides [10511-62]
10511 1R	Grain growth and significant Fe diffusion in polycrystalline ZnS at elevated temperatures and pressures [10511-63]
10511 1S	Quasi-three level Nd:YLF fundamental and Raman laser operating under 872-nm and 880- nm direct diode pumping [10511-64]
10511 1U	Thermo-optical properties of Alexandrite laser crystal [10511-75]
	POSTER SESSION
10511 1V	Dual-wavelength Nd:CaLnAlO₄ lasers at 1.365 and 1.390 μm [10511-28]
10511 1X	Dual-wavelength operation of a continuous-wave Alexandrite laser [10511-67]
10511 1Y	Passively mode-locked Nd:YVO4 laser operating at 1073 nm and 1085 nm [10511-68]
10511 1Z	Dual-wavelength Yb:CALGO laser with 1.31 THz frequency offset [10511-69]
10511 20	Error tolerance analysis of wave diagnostic based on coherent modulation imaging in high power laser system [10511-70]
10511 21	Temperature influence on spectroscopic properties and 2.7-µm lasing of Er:YAP crystal [10511-71]
10511 22	Temperature influence on spectroscopic and lasing properties of blue laser diode pumped Alexandrite crystal [10511-72]
10511 24	Resonantly diode-pumped eye-safe Er:YAG laser with fiber-shaped crystal [10511-74]
	Temperature influence on spectroscopic and lasing properties of blue laser diode pumped Alexandrite crystal [10511-72]

- 10511 25 Spectroscopy and lasing of Tm:SrMoO₄ crystal near 1.5, 1.9, and 2.3-μm under 793-nm excitation [10511-76]
- 10511 26 **Optimized Ce:LiCAF amplifier pumping configurations** [10511-77]
- 10511 28 **Fe:Zn<sub>0.6</sub>Mn<sub>0.4</sub>Se laser generation at 5.0 5.8 μm in the temperature range of 78 300 K** [10511-79]
- 10511 2A Efficient Ti:LiNbO<sub>3</sub> ridge waveguide lasers: investigation of Er and Yb:Er doped waveguides pumped at 980nm and 1486nm [10511-81]
- 10511 2C Semiconductor-based narrow-line and high-brilliance 193-nm laser system for industrial applications [10511-83]
- 10511 2D Laser spectroscopy of highly doped NV<sup>-</sup> centers in diamond [10511-84]
- 10511 2E High power diode pumped solid state (DPSS) laser systems active media robust modeling and analysis [10511-85]
- 10511 2F Enhancement of thermal blooming effect on free space propagation of high power CW laser beam [10511-86]
- 10511 2H High-frequency strontium vapor laser for biomedical applications [10511-88]
- 10511 2I GHz Yb:KYW oscillators in time-resolved spectroscopy [10511-89]
- 10511 2J Excitation of higher lying energy states in a rubidium DPAL [10511-92]
- 10511 2K Excited argon 1s₅ production in micro-hollow cathode discharges for use as potential rare gas laser sources [10511-93]
- 10511 2L Investigation on gas medium parameters for an ArF excimer laser through orthogonal experimental design [10511-94]
- 10511 2M CW 3µm lasing via two-photon pumping in cesium vapor with a 1W source [10511-96]