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Laser Damage II

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Since the first report in 1964, laser damage (LD) of optical materials continues to limit the output energy and power of pulsed and continuous-wave laser systems. In spite of some 50 years of research efforts in this area, interest of the international laser community to laser damage issues remains at a very high level and even increases with the development of novel laser systems. The interest is evident from the high level of attendance and presentations at the annual SPIE Laser Damage Symposium (aka, Boulder Damage Symposium) that has been held in Boulder, Colorado, since 1969. Intensive developments of high-power lasers and applications in Southeast Asia have motivated establishing a partner Pacific Rim Laser Damage conference, first held in 2009 by Shanghai Institute of Optics and Mechanics (China) in cooperation with SPIE. Since the first special section of *Optical Engineering* on laser damage (December 2012), many significant results have been presented at those two meetings. This special section of *Optical Engineering* is the second one prepared in response to continuously growing interest from the international laser-damage community. Also, it has been motivated by multiple requests from researchers of that community and by the pivotal success of the first special section on laser damage. Some papers from this special section were presented at the Laser Damage Symposium and Pacific Rim Laser Damage conference; others were submitted in response to the general call for papers for this special section.

The 16 papers selected out of 21 submissions and compiled into this special section represent the entire broad area of laser-damage research. The fundamental mechanisms of LD are considered by [R. A. Mitchell et al.](#) (particle-in-cell simulations of surface damage), and [V. Gruzdev](#) (laser-induced ionization of solids). Various aspects of multi-layer coating and thin-film characterization are considered in papers by [S. Papernov et al.](#) (near-UV absorption annealing of HfO₂ films), [D.-B. Douli et al.](#) (LD of thin films with multiple subpicosecond pulses), and [E. Field et al.](#) (effect of cleaning methods on LD of antireflection coatings). Material characterization is represented by the papers devoted to laser calorimetric measurements of low absorption ([I. Balasa et al.](#)),

and accelerated lifetime testing of fused silica ([C. Mühlig and S. Bublitz](#)). Laser-metal interaction is covered by the papers of [A. M. Rubenchik et al.](#) (temperature-dependent absorption), and [S. M. Baumann et al.](#) (laser-induced heating and penetration in share flow). Measurements related to LD are considered in papers by [A. Hildenbrand et al.](#) (LD measurements in nonlinear crystals CdSiP₂ and Zn GeP₂), [A. Stratan](#) (effective laser spot measurements), and [J. W. Arenberg and M. D. Thomas](#) (statistical treatment of measurements of the LD threshold). Papers of [M. Lu et al.](#) (effect of etching on LD properties of artificial defects) and [T. Ding et al.](#) (ultrasonic cleaning for optical substrates with artificial defects) are from the extended field of surface characterization and LD. Another paper is devoted to single-mode fiber degradation by 405-nm CW laser ([C. P. Gonschior](#)). Finally, characterization of peening-induced effects by thermoelectric methods is considered by [H. Carreon et al.](#)

The emerging research developments in the field of laser damage and optical materials for high-power lasers represented by these papers will be very beneficial for readers of *Optical Engineering* and researchers from multiple related areas.

Vitaly E. Gruzdev received an MS in optical systems and devices from the Institute of Fine Mechanics and Optics in St. Petersburg, Russia, in 1994, and a PhD from S. I. Vavilov State Optical Institute in St. Petersburg, Russia, in 2000 in the field of optics. Currently, he is a research assistant professor with the Department of Mechanical and Aerospace Engineering of the University of Missouri. Since 2009, he is a co-chair of the SPIE Laser Damage Symposium. His current fields of research interests include laser-induced ionization and ultrafast laser-solid interactions.

Michelle D. Shinn has been at Jefferson Lab since 1995. She was named chief optical scientist for the Free-Electron Laser (FEL) Division in 2006. She actively collaborates with a number of teams that use the FEL, and in particular, pursues her own research on the characterization of dielectric thin films for laser applications, and laser-induced damage of optical components. A member of the Accelerator Division Management Department since August 2013, she has been on a detail assignment to the Facilities and Program Management Division of the Office of Nuclear Physics of the US Department of Energy Office of Science.