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Reflective photonic limiter based on a phase-changing material[1]
RODION KONONCHUK, ANDREY CHABANOV, Department of Physics Astronomy, University of Texas at San Antonio TX, USA, MARTIN HILARIO, BENMAAS JAWDAT, BRAD HOFF, Air Force Research Laboratory, Directed Energy Directorate, KAFB, NM, US, VLADIMIR VASILYEV, NICHOLAOS LIMBEROPOULOS, ILYA VITEBSKIY, Air Force Research Laboratory, Sensors Directorate, WPAFB, OH, USA — Optical limiters protect the human eye and sensitive optical devices from laser-induced damage. The existing limiters utilize nonlinear optical materials which transmit low-intensity light, while blocking the laser radiation with intensity exceeding a certain limiting threshold. The limiting threshold is determined by nonlinear absorption and, in many cases, is much higher than the practically required value. An additional problem with the existing limiters is that the laser-induced damage threshold of the nonlinear material is usually close to the limiting threshold, in which case the limiter itself can be irreversibly damaged if engaged. To address the above problems, we have developed a reflective limiter in which the phase-change material, VO2, is incorporated in a photonic structure with engineered dispersion. At low intensities, the photonic structure displays a strong resonant transmission. Above the limiting threshold, VO2 undergoes a heat-induced transition to the metallic phase to render the photonic structure highly reflective, which prevents it from overheating and destruction. Such a photonic limiter has significantly lower limiting threshold and much higher damage threshold compared to VO2 itself. The photonic limiter is going to be tested with millimeter waves.

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Rodion Kononchuk
University of Texas at San Antonio TX, USA

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