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CdSiP2 picosecond optical parametric generator

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The nonlinear crystal, CdSiP2 (CSP) is a recently developed optical material which offers unique linear and nonlinear properties for parametric down-conversion into the mid-IR. It is a negative uniaxial chalcopyrite with a transparency above ~6500 nm, which possesses a noncritical phase-matching (NCPM) capability with a maximum effective nonlinear coefficient as high as 84.5 pm/V. Importantly, CSP has a band-gap well below 1 micron, which permits pumping at 1064 nm, and under type I (e oo) parametric generation with NCPM can provide an idler wavelength near 6400 nm, a spectral range of great interest for medical applications. In recent studies, the potential of CSP for the generation of mid-IR radiation using direct pumping at 1064 nm was demonstrated using optical parametric oscillators in the nanosecond. sub-nanosecond, and synchronously-pumped picosecond time-scales. Here, we report efficient generation of picosecond pulses in near- and mid-IR in CSP at a repetition rate as high as 100 kHz using single-pass optical parametric generation (OPG) pumped by a mode-locked and amplified Nd:YVO4 laser at 1064 nm. We demonstrate an average signal power of 1.16 W at 1282 nm and idler power of 154 mW at 6204 nm, for for 6.1 W of pump, corresponding to photon conversion efficiencies of 25% and 15%, respectively. We also report spatial, temporal and spectral characterization of the signal and idler output, where we obtain near-Gaussian profiles for both beams, a signal pulse duration of 6.36 ps with a FWHM bandwidth of 8.5 nm, and an idler bandwidth of 122 nm.