Effective third harmonic generation based on $Ba_3(ZnB_5O_{10})PO_4$ crystal

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Nonlinear optical (NLO) frequency conversion has become one of the main ways to realize the UV band lasers owing to the advantages of high reliability, high beam quality and low maintenance cost. Recent researches on borate-phosphate NLO crystals have been attracting the increasing interests owing to their capability to exhibit very short absorption edge and large SHG response. $Ba_3(ZnB_5O_{10})PO_4$ (BZBP) crystal has a large second-order nonlinear optical coefficient on the main axis direction (d_{31}≈1.62 ppm/V on the *z* axis) [1] and a moderate birefringence of 0.033 at 1064 nm [2]. Additionally, it has a large transmission range from 230 nm to 2500 nm, a moderate thermal conductivity of 1.77-2.11 W/mK, a high damage threshold (≈1.0 GW/cm^2), and a small absorption coefficient of 40 ppm/cm at 1064 nm. Moreover, BZBP is a non-hygroscopic crystal and can be achieve high optical quality large size single crystal by top-seeded solution growth method [3]. These characteristics make BZBP became a potential THG NLO crystal. The THG type-I PM angle of θ=90°, Φ=73.2°. Using nanosecond 1064 nm laser as pumping source, the type-I LBO as SHG crystal, type-I BZBP as THG crystal, the 355 nm laser could be achieved the highest output energy of 52 mJ, and the maximum conversion efficiency of 24.5%. As a comparison, the type-I LBO THG laser with the energy of 36.6 mJ was obtained with conversion efficiency of 16.4%. These results indicate that the BZBP crystal is a promising UV NLO material, and the scheme provides more material options for THG 355 nm lasers.

References (if needed)

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