High-power ultraviolet laser generation at 355 nm and 266 nm using sum-frequency method based on $La_2CaB_{10}O_{19}$ crystal

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Ultraviolet (UV) laser is favored in the field of laser technology due to its unique advantages of short wavelength, high photon energy, small diffraction effect, high resolution, and so on. UV nonlinear optical (NLO) crystals are the key to produce UV laser by frequency conversion technology. $La_2CaB_{10}O_{19}$ (LCB) is an outstanding NLO borate crystal that can realize UV laser generation. LCB is relatively easier to grow at low cost and exhibits good chemical stability and superior mechanical properties. The effective nonlinear coefficient (d_{eff}) of LCB is similar to LBO crystal, what's More, it can be used in the common conditions for a long time because of its non-hygroscopicity, which makes LCB a competitive candidate for UV laser generation.

In previous research work, we have achieved as high as 31.6 W nanosecond (ns) UV laser at 355 nm with LCB crystals (the maximum conversion efficiency from 1064 nm to 355 nm was 28.9%). And in recent years, we have continuously optimized the growth process of LCB crystals. High optical quality LCB crystals were grown by the new Li_2O-B_2O_3-MoO_3 flux system with low viscosity using the top-seeded solution growth (TSSG) method. Using these crystals, we obtained over 20 W picosecond (ps) ultrafast UV laser generation at 355 nm with high stability. More importantly, by using the sum-frequency-generation (SFG) method ($\omega + 3\omega \rightarrow 4\omega$), we also achieved the short-wave UV laser generation at 266 nm with high power and high conversion efficiency for the first time by using LCB crystal, which is expected to further expand the practical application range of LCB crystal.