Recent progress in brightness scaling by coherent beam combining of tapered amplifiers for efficient high power frequency doubling - DTU Orbit (09/04/2019)

High brightness diode laser beam combining techniques are in demand for efficient high power nonlinear conversion. Coherent beam combining (CBC) is the only method that has the potential for brightness scaling by maintaining one single narrow spectral linewidth. CBC in a master oscillator power amplifier (MOPA) configuration using a small number of efficiently cooled tapered amplifiers is a promising approach for efficient brightness scaling in a simple architecture. We present the application of such a source based on CBC of three tapered amplifiers seeded by a DFB laser at $\lambda = 976$ nm for second harmonic generation (SHG). A maximum power of 2.1 W at 488 nm was generated by SHG in a MgO:PPLN bulk crystal limited by thermal effects. A clear benefit of the beam clean-up resulting from the CBC setup was documented leading to an improved nonlinear efficiency. As part of our ongoing studies into further brightness scaling in CBC architectures, we present an experimental analysis of the phase dynamics of tapered amplifiers in quasi continuous operation (QCW) at high currents. Furthermore, we are investigating different amplifier designs for improved beam quality at high powers and therefore improved combining efficiency.