

# Influence of Core Coupling on Spectral Characteristics of 7-Core Yb-Doped Fiber Laser with fs-Inscribed FBGs

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Multicore fibers (MCFs) are treated now as a perspective medium for high-power fiber lasers/amplifiers which may overcome limitations imposed in singlemode fibers by nonlinear effects such as beam self-focusing, transverse mode instability, modulation instability, stimulated Raman scattering, *etc.* [1]. With the use of well-developed techniques of coherent beam combining [2], the generated beams can be efficiently combined into one high-quality output beam. A required phase-time synchronization of the core modes in MCFs can be realized through either external optical elements or inherent optical cross-coupling between the individual cores, which significantly reduces the complexity of system control. Together with a possibility to use common source (preferably a laser diode) for pumping all cores simultaneously and to embed cavity elements inside the fiber, the coupled-core MCFs offer an opportunity to develop compact all-fiber lasers with high output power, beam quality and stability in CW and pulsed regimes

In this work we report on the point-by-point femtosecond (fs) inscription of highly-reflective fiber Bragg grating (FBG) array in all cores of 7-core Yb-doped fibers. By using such complex mirror, we achieve high-power laser generation at a wavelength of 1064 nm in two types of active MCF with different core-to-core distance. At cladding pumping by a 976-nm laser diode of 50 W power, both the MCFs with FBG cavity generate nearly the same output power of up to 33 W, but the laser spectra behave principally different since the generation of the cores is almost independent or strongly coupled in these two cases (figure 1). To study the effect, we develop analytical model and perform its experimental verification identifying the role of core coupling and FBG characteristics on the generated mode and its spectrum.

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## References

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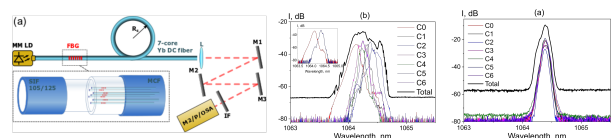


Figure 1: (a) Multicore Yb fiber laser scheme; (b) laser spectra at 10W power for net beam and individual (inset: C0,5) uncoupled cores; laser spectra at 10W power for net beam and individual coupled cores (c)