WS2 Progress in rare-earth-doped fiber lasers

DAVID N. PAYNE, U. Southampton, Department of Electronics & Computer Science, Highfield, Southampton, Hants S09 5NH, U.K.

Single-mode fiber with rare-earth-doped cores have stirred considerable interest since their introduction.[1] Already a variety of devices and applications have emerged, including fiber lasers,[2] in-line amplifiers,[3] distributed sensors,[4] absorption filters,[5], and bistable switches.[6]

Optical fibers provide an ideal medium for optical interactions with rare-earth impurities, since they exhibit very low loss (a few dB/km) and can hold a tightly focused beam for great lengths. This permits fluorescent sensor or laser devices of hundreds of meters to be constructed. Conversely, using higher doping, miniature diode-pumped fiber lasers of a few centimeters can be obtained. A further advantage is that the devices are compatible with conventional optical fibers and thus can be efficiently spliced to a wide variety of fiber components, such as gratings,[7] polarizers,[8] and couplers.[9]

Our intention is to review here the rapid progress in this new field. Emphasis is placed on rare-earth spectroscopy in fibers including a variety of as yet unreported dopant and glass matrix combinations. Tunable fiber lasers operating at 0.9, 1.06, 1.08, and 1.55 μm are described together with recent results on Q-switching[10] and mode locking. In the sensor field, rare-earth-doped fiber applications exploiting fiber laser sources or absorptive and fluorescent effects are outlined.

(invited paper, 25 min)

1. S. B. Poole, D. N. Payne, and M. E. Fermann, Electron. Lett. **21**, 737 (1985).
2. R. J. Mears, L. Reekie, S. B. Poole, and D. N. Payne, Electron. Lett. **21**, 738 (1985).
3. R. J. Mears, L. Reekie, I. M. Jauncey, and D. N. Payne, in *Optical Fiber Communication Conference–Sixth International Conference on Integrated Optics and Optical Fiber Communication* (Optical Society of America, Washington, DC, 1987), paper WI2.
4. M. C. Farries, M. E. Fermann, S. B. Poole, and J. E. Townsend in *Optical Fiber Communication Conference–Sixth International Conference on Integrated Optics and Optical Fiber Communication* (Optical Society of America, Washington, DC, 1987), paper WI5.
5. M. C. Farries, J. E. Townsend, and S. B. Poole, Electron. Lett. **22**, 1126 (1986).
6. L. Reekie, R. J. Mears, S. B. Poole, and D. N. Payne, in *Technical Digest, Twelfth European Conference on Optical Communication*, Barcelona (1986), p. 225.
7. I. M. Jauncey *et al.*, Electron. Lett. **22**, 987 (1986).
8. L. Li, G. Wylangowski, D. N. Payne, and R. D. Birch, Electron. Lett. **22**, 1020 (1986).
9. I. D. Miller, D. B. Mortimer, B. J. Ainslie, N. P. Urquhart, S. P. Craig, C. A. Millar, and D. B. Payne, in *Optical Fiber Communication Conference–Sixth International Conference on Integrated Optics and Optical Fiber Communication* (Optical Society of America, Washington, DC, 1987), paper WI3.
10. I. P. Alcock, A. C. Tropper, A. I. Ferguson, and D. C. Hanna, Electron. Lett. **22**, 85 (1986).