

## Multi-Wavelength Q-Switched Erbium-Doped Fiber Laser with Photonic Crystal Fiber and Multi-Walled Carbon Nanotubes

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**Abstract :** A simple multi-wavelength passively Q-switched Erbium-doped fiber laser (EDFL) is demonstrated using low cost multi-walled carbon nanotubes (MWCNTs) based saturable absorber (SA), which is prepared using polyvinyl alcohol (PVA) as a host polymer. The multi-wavelength operation is achieved based on nonlinear polarization rotation (NPR) effect by incorporating 50 m long photonic crystal fiber (PCF) in the ring cavity. The EDFL produces a stable multi-wavelength comb spectrum for more than 14 lines with a fixed spacing of 0.48 nm. The laser also demonstrates a stable pulse train with the repetition rate increases from 14.9 kHz to 25.4 kHz as the pump power increases from the threshold power of 69.0 mW to the maximum pump power of 133.8 mW. The minimum pulse width of 4.4  $\mu$ s was obtained at the maximum pump power of 133.8 mW while the highest energy of 0.74 nJ was obtained at pump power of 69.0 mW.

**Keywords :** multi-wavelength Q-switched, multi-walled carbon nanotube, photonic crystal fiber

**Conference Title :** ICOP 2014 : International Conference on Optics and Photonics

**Conference Location :** Bali, Indonesia

**Conference Dates :** October 09-10, 2014