Q-switched and mode-locked thulium-doped fiber laser with pure Antimony film Saturable absorber

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Abstract
Stable and compact Q-switched and mode-locked thulium-doped fiber laser (TDFL) is demonstrated by employing Antimony (Sb) film Saturable absorber (SA) in the ring cavity. The Sb film SA is fabricated by sputtering a thin layer of Sb element onto polyvinyl alcohol (PVA) thin film. Self-pulsed TDFL Q-switched with repetition rate and pulse width of 14.5 kHz to 23.6 kHz and 13.4 μs to 3.9 μs respectively are obtained, as the pump power raises from the threshold (271 mW) to its maximum (396 mW). The TDFL Q-switched output is centered at 1947 nm wavelength. At the maximum pump power (396 mW), the maximum peak power and the maximum pulse energy are obtained at 24.4 mW and 120.12 nJ respectively. Meanwhile, self-starting mode-locked TDFL emerges as the pump power rises from 456 mW to 582 mW. The TDFL mode-locked output spectrum is centered at 1934 nm wavelength. A nearly constant repetition rate of 8.06 MHz and pulse width of 64 ps are observed, as the pump power rises to the maximum (582 mW). The results verify that the pure Sb (PVA film) evaporated SA is capable to construct stable and reliable short pulse laser in the 2-micron regime.

Keywords
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