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Bismuth Oxide Nanoflakes for Passive Q-Switching in a C-band Erbium Doped Fiber Laser

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Abstract

In this work, bismuth oxide (Bi_2O_3) nanoflakes suspended in a polyvinyl alcohol (PVA) host is used as a saturable absorber (SA) in an erbium-doped fiber laser (EDFL). The facile hydrothermal method is employed to synthesize the Bi_2O_3 nanoflakes as the SA, which provides stable Q-switching at a central wavelength of 1564 nm with a maximum pulse energy of 21.31 nJ. The generated pulses have repetition rates of 28.41 kHz to 49.51 kHz and pulse widths of 4.9 μs to 1.55 μs over the available pump power range. The Bi_2O_3-PVA based SA also has a high signal-to-noise ratio (SNR) of 51.28 dB, indicating a significantly stable output and demonstrating the high potential of the fabricated Bi_2O_3-PVA film for practical applications. To the best of the author's knowledge, this is the first report of the use of a Bi_2O_3-PVA based SA for Q-switching in a C-band EDFL region.

Keywords: Bismuth oxide; Transition metal oxide; Saturable absorber; Passively Q-switched; Erbium doped fiber; C-band.

Introduction

Recent advances in the development of fiber lasers have seen an increased focus towards the generation of Q-switched pulses with high pulse energies and long durations [1] that make them ideal for use in various applications such as material processing [2], remote sensing [3], range finding [4], and medicine [5]. In this regard, passively Q-switched