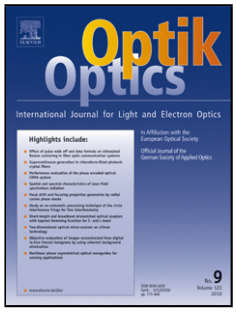

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High energy mode-locked Yb-doped fiber laser with Bi_2Te_3 deposited on tapered-fiber

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Abstract

The report presents the high energy mode-locking operation in an all-normal-dispersion Yb-doped mode-locked fiber laser based on evanescent field interaction with tapered fiber deposited with Bi_2Te_3 topological insulator. Different from most of solution processing methods, Bi_2Te_3 film is deposited on the tapered fiber by pulsed laser deposition (PLD) technology. In this way, it can bring less non-saturable losses and contact to the fiber better. By incorporating this novel fiber-taper Bi_2Te_3 saturable absorber into Yb-doped fiber laser cavity, a repetition rate of 6.2 MHz mode-locked fiber laser is achieved. The maximum single pulse energy of 2 nJ is obtained. The results indicate that fiber-taper Bi_2Te_3 saturable absorber possesses potentiality for high power mode-locked fiber laser applications.

Key Words: fiber laser; mode-locking; saturable absorber

1. Introduction

High energy pulse with nanosecond duration is suitable for laser processing, optical time domain reflectometer (OTDR), second-harmonic generation, and microstructure evolution [1]. Elongating all-normal-dispersion fiber laser cavity has been widely investigated as a means of obtaining high pulse energy [2]. Passively mode-locking techniques based on nonlinear polarization evolution (NPE) and nonlinear optical loop mirror (NOLM) have been used to obtain low cost and compact ultrafast lasers [3, 4]. Saturable absorber (SA) whose light absorbance decreasing with the increasing of light intensity is also considered to be an effective method to achieve the mode-locking operation in fiber lasers [5-10]. Semiconductor saturable absorber mirrors (SESAMs) have been paid much attention in ultrafast laser area, while the commercial applications of SESAMs are limited by complicated fabrication, narrow band wavelength and expensive price [11]. Carbon nanotube, zero-gap material graphene, topological insulators (TIs), transition metal dichalcogenides (TMDs) and black phosphorus (BP) have achieved great success in SA applications for the advantages of wavelength-independent saturable absorbing characteristics, low saturable absorbing threshold, and large