Q-switched Er-doped fiber laser with low pumping threshold using graphene saturable absorber

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CHINESE OPTICS LETTERS
Volume: 12 Issue: 9
Article Number: 091404
DOI: 10.3788/COL201412.091404
Published: SEP 10 2014

Abstract
We propose a Q-switched Er-doped fiber laser (EDFL) with a threshold pumping power as low as 7.4 mW, and demonstrate using graphene polyvinyl alcohol (PVA) thin film as a passive saturable absorber (SA). The SA is fabricated from graphene flakes, which is synthesized by electrochemical exfoliation of graphite at room temperature in 1% sodium dodecyl sulfate aqueous solution. The flakes are mixed with PVA solution to produce a thin film, which is then sandwiched between two ferrules to form a SA and integrated in the EDFL ring cavity to generate a stable Q-switched pulse train. The pulse train operates at 1560 nm with a threshold pump power of 7.4 mW. At maximum 1480 nm pump power of 33.0 mW, the EDFL generates an optical pulse train with a repetition rate of 27.0 kHz and pulse width of 3.56 μs. The maximum pulse energy of 39.4 nJ is obtained at a pump power of 14.9 mW. This laser can be used as a simple and low-cost light source for metrology, environmental sensing, and biomedical diagnostics.

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Funding

<table>
<thead>
<tr>
<th>Funding Agency</th>
<th>Grant Number</th>
</tr>
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<tbody>
<tr>
<td>Ministry of Education</td>
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<tr>
<td>University of Malaya</td>
<td>ER012-2013A</td>
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<td>RP008D-13AET</td>
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