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SUPPORTING INFORMATION

Broadband laser polarization control with aligned carbon nanotubes

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The polarization performance depends on the ACNT film thickness:

In order to optimize the polarization performance, the 1.5 μm laser system was utilized to test the DOP and ER with different ACNT film thicknesses. The result shows that thicker ACNT film gives better performance, and the output performance saturates with the ~300 nm film, illustrated in Fig. S1. Therefore, in our experiment, we selected ~300 nm thick film to get the experimental results discussed in the main text. The highest DOP and ER value are obtained to be ~86% and 10.2 dB respectively, which are in correspondence with the data in the paper.

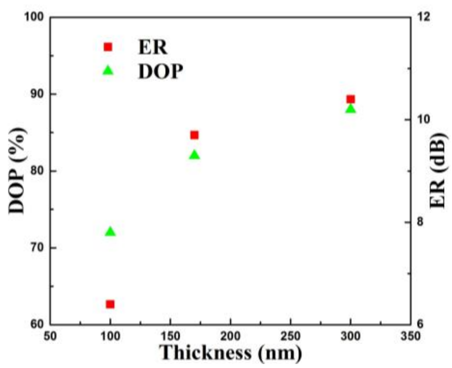

Fig. S1 The relationship between the ACNT film thickness and the polarization performance (DOP and ER).

Polarization performance comparison between ACNT device and prism based polarizer:

We compared our ACNT laser performance with a traditional prism based polarizer (Thorlabs, GL10), as shown in Fig. S2. It shows that the polarization performance with the prism is slightly higher (~7% at 1 μm, ~8% at 1.5 μm) than from the laser with the ACNT device. This demonstrates that our ACNT device performance is very comparable to the prism based polarizer, for laser polarization control (andwith a broad operation bandwidth (at both 1 and 1.5 μm)). Note that our ACNT fabrication method is compatible to other photonic devices (e.g., fibers and silicon devices), which can offer huge flexibility to be integrated into various photonic platforms (e.g., waveguides) for a large range of photonics applications.

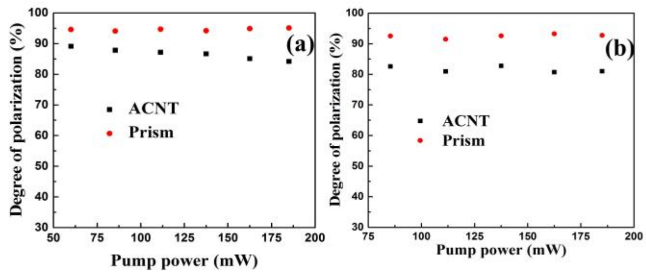

Fig. S2 DOP performance comparison between our ACNT device and a prism based polarizer in (a) 1 μm, and (b) 1.5 μm laser systems.

Gain coefficient of the gain fiber and its comparison with ACNT absorption:

The gain coefficients of our Yb-doped and Er-doped fibers were tested, illustrated in Fig. S3. The value ranges from 2 dB to 25 dB for the Yb-doped fiber, and from 3 dB to 17 dB for the Er-doped fiber.

We also compare the relationship between the gain coefficient and the absorbance of ACNT, shown in Fig. S4. It appears that the gain (~1000% and ~1580% at 1 μm and 1.5 μm laser respectively, under the pump power of 75 mW) is much higher (>~5000 times) than the typical absorption of our ACNT device.

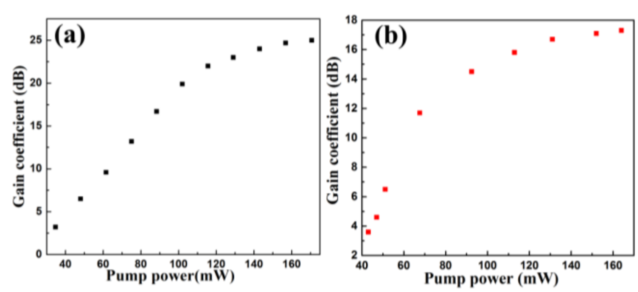

Fig. S3 The gain coefficient for our (a) Yb-doped and (b) Er-doped fibers, as a function of pump power.

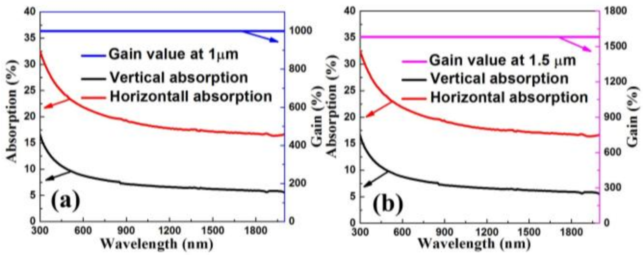

Fig. S4 The absorption at vertical and horizontal directions, and the gain value of the gain medium under pump power of 75 mW (corresponding to the best polarization performance output) at 1 μm (a) and 1.5 μm (b).

