Figure caption

Figure 1 Optical characterisation of SWCNT PVA SA. (a) linear optical absorption measurement of SWCNT PVA film and pure PVA.(b) Raman spectrum measurement of the SWCNT PVA film. (c) Nonlinear optical absorption measurement of the SWCNT PVA SA.

Figure 2 Schematic picture of the NOLM-NALM SWCNT hybrid Q-switched TDFL. A fibre laser built in Ying-Yang cavity configuration including high concentration thulium-doped fibre (TDF), polarisation controllers (PCs), 1550/2000 wavelength division multiplexor (WDM), SWCNT dispersed in PVA-based film sandwiched between two optical connectors, two output couplers with variable coupling ratios, and 1550 nm Fabry-Perot laser diode amplified by EDFA to the maximum pump power of 1.2 W. The total lengths of NOLM (ABCEA), NALM (CDAEC), and common part are 3.5, 3.8, and 0.7 m correspondingly.

Figure 3 Laser output dynamics against the coupler ratios. (a) laser slope efficiency of output1 at various coupling ratios.

Figure 4 Output pulse properties at optimised condition. (a) optical spectrum, measured at different laser outputs. (b) recorded oscillograms at different sampling times (i) 10 μs; (ii) 100 μs; (c) repetition rate and pulse duration variation against pump power; (d) output pulse energy and peak power variation against pump power. Inset: laser efficiency; (e) measured RF spectra at different output port.

**Figure 5 (a) Output power ratio of output 2 to output 1 at various coupling ratio. (b) Typical oscilloscope traces of laser output with different ouput1 (lower yellow trace) to output2 (upper blue trace) coupling ratios, (c) NOLM and NALM transmission at variable pulse peak power, and (d) laser efficiency at 35/65 to 65/35 (i), 65/35 to 80/20 (ii), 80/20 to 80/20 (iii) coupling ratios, correspondingly.**

**Figure 6 Schematic picture of the power-dependent characteristics measurements.**