Supporting Information

Waveguide and Ultralow-Threshold Amplified Spontaneous Emission in Aligned Ordered Solid State Based on Highly Fluorescent Twin-tapered Bi-1,3,4-oxadiazole Derivative

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Experimental

General information: BOXD-T3 was prepared following our previously published procedures. BOXD-T3 vacuum deposited film was prepared by high-vacuum (6×10^{-5} Pa) thermal evaporation method. Film thicknesses were measured with an Ambios XP-1surface profiler. PL spectra were collected using a Hitachi F-4500 spectrometer. UV-visible absorption spectra were recorded on a Shimazu UV-3101PC spectrophotometer. Photoluminescence quantum yield in solution (excitation wavelength: 340 nm) was determined relative to a solution of quinine bisulfate in sulfuric acid aqueous solution (Φ_F = 0.515). Photoluminescence quantum yield in solid state is obtained in a calibrated integrating sphere (excitation wavelength: 340 nm). Fluorescence lifetimes were measured using FL920 time-corrected single photon counting (TCSPC) system. FE-SEM observations were taken with a Hitachi S-4800 apparatus. The POM and fluorescence microscopy images were carried out with an Olympus BX51TRF microscope. The light source for fluorescence microscopy observation was a mercury lamp with a fluorescent filter cube, which provides excitation in the range of 330-385 nm, and collects the emission at > 420 nm. Intensity of the fluorescence emission was measured using the built-in CCD camera along with the associated software. X-ray

diffraction (XRD) was carried out with a Bruker Advance D8 X-ray diffractometer. ASE investigation was performed using a Nd:YAG laser with a repetition rate of 10 Hz and pulse duration of about 10 ns. BOXD-T3 cyclohexane solution was contained in 1 cm optical-path quartz cells. The excitation 355 nm laser source was normally focused onto the quartz cells or the film (the focused pumping stripe along the alignment of the film) in a 6 mm×0.6 mm stripe by a cylindrical lens. The polarization direction of pumping source was perpendicular to the focused pumping stripe. The emission spectra were detected using an Ocean Optics Maya 2000 Pro Fiber Optic Spectrometer. The laser power was detected by Newport 2936C laser power meter. The film thickness could be controlled during the solution procession by modulating the concentrations and the solvents evaporating rates.

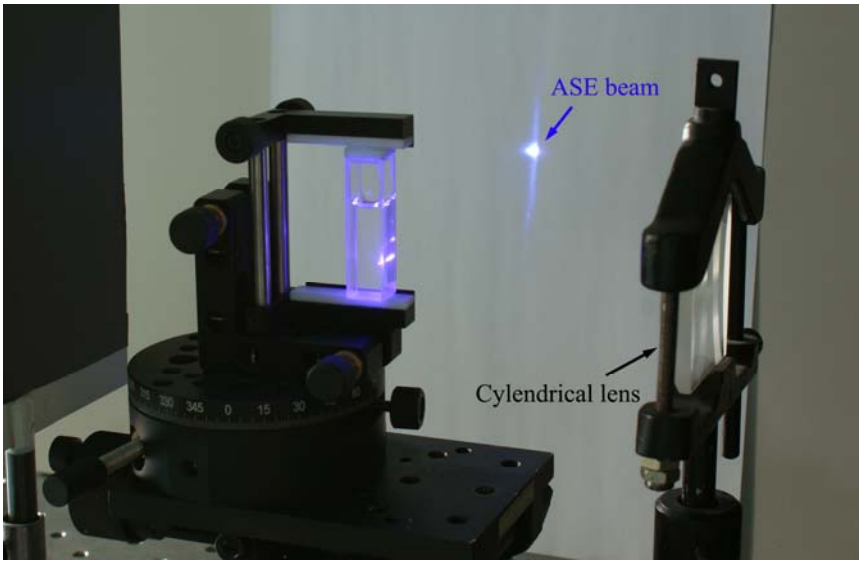

Figure S1. Photograph of the ASE from BOXD-T3 cyclohexane solution at 1×10^{-3} mol/L at the excitation power of 220 kW/cm^2.

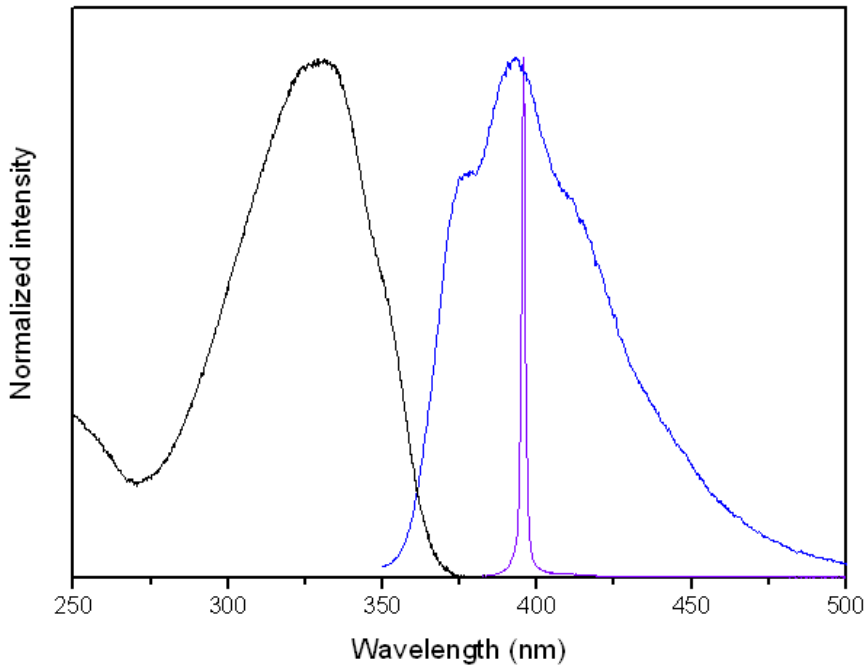

Figure S2. Normalized absorption (black), PL (blue) of BOXD-T3 in cyclohexane at 5×10^{-4} mol/L, and ASE (purple) spectra of BOXD-T3 in cyclohexane at 1×10^{-3} mol/L.

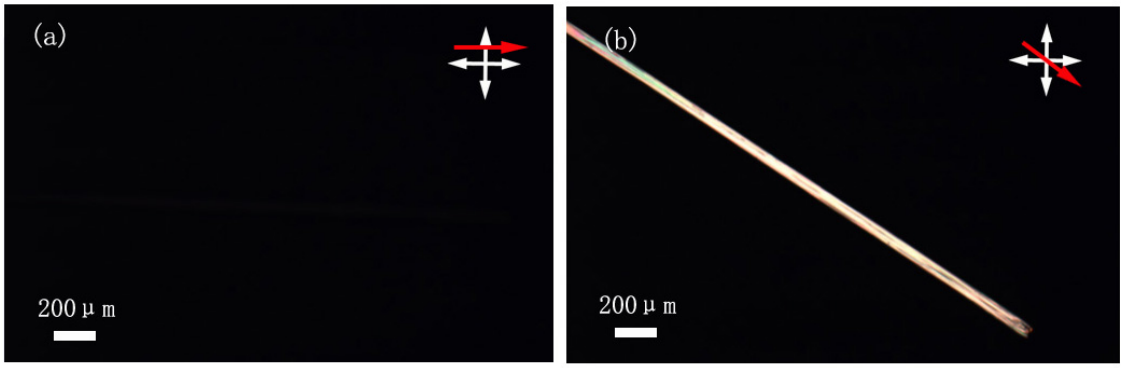

Figure S3. POM images of a solution processed microbelt of BOXD-T3. White crossed arrows illustrated the crossed-polarizers and red arrow illustrated the direction of the microbelt.

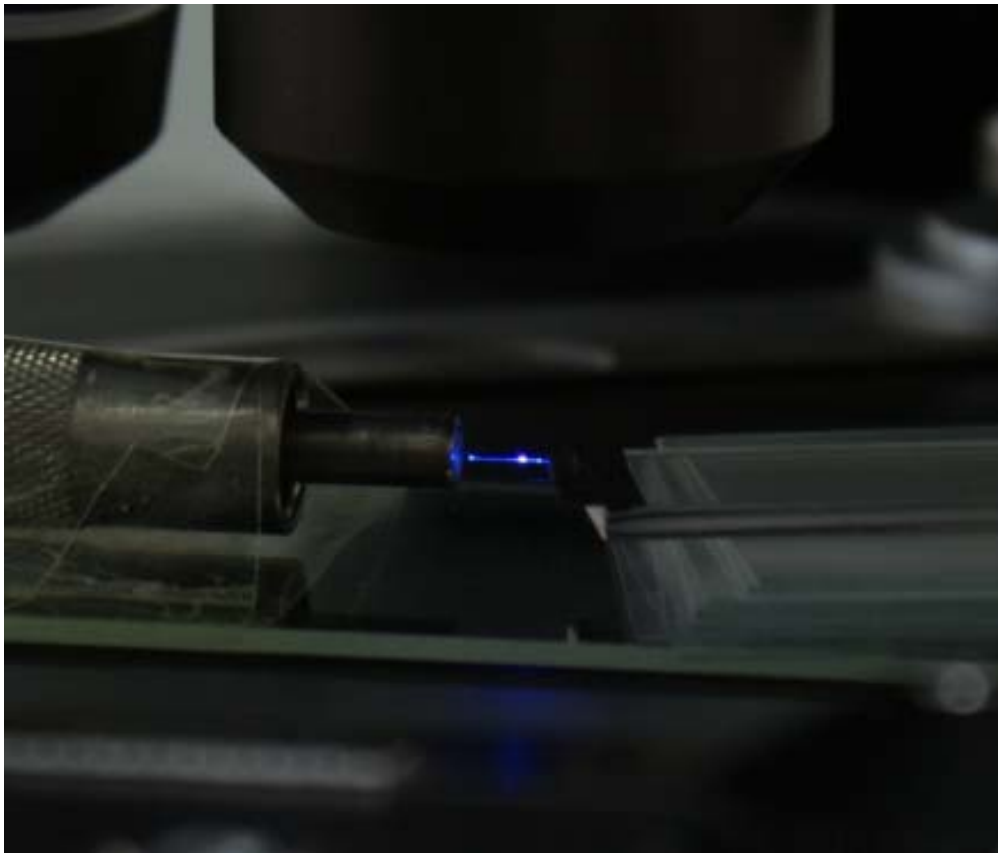

Figure S4. Photograph of the measurement of the self-waveguided behavior within a larger BOXD-T3 belt under Olympus BX51TRF microscope. The excitation UV lights (330-385 nm) was refined into a 80 μm spot on the belt. The fiber-coupled CCD spectrograph was held stationary over one of the ends of the belt, which was moved by an attachable graduated mechanical stage.

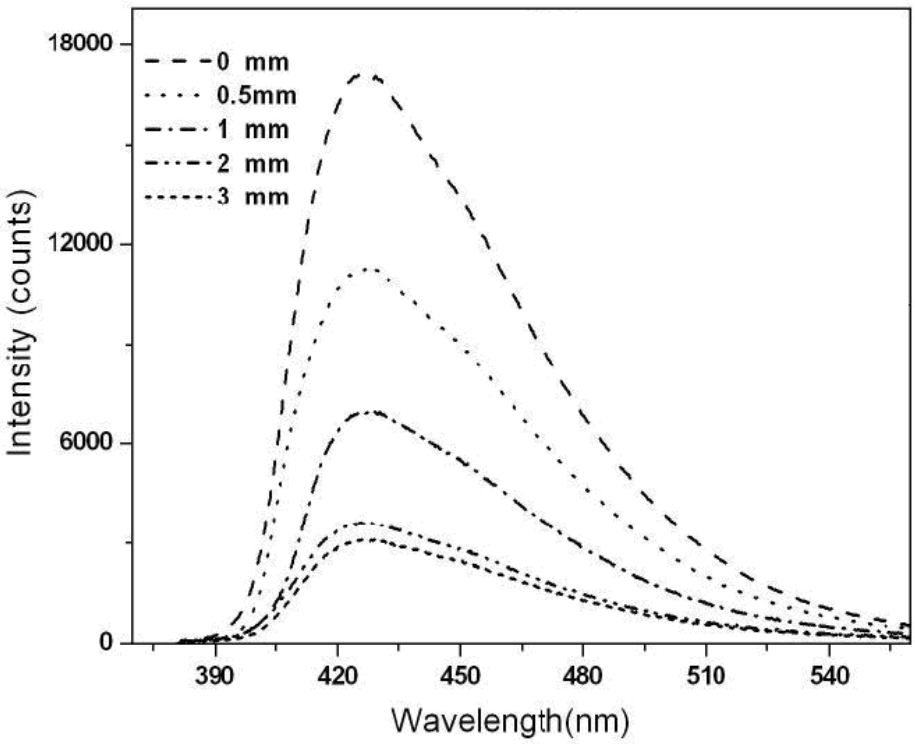

Figure S5. Spatially resolved PL spectra of the emission that is outcoupled at the tip of the large microbelt from a distance of 0-3 mm from the tip.

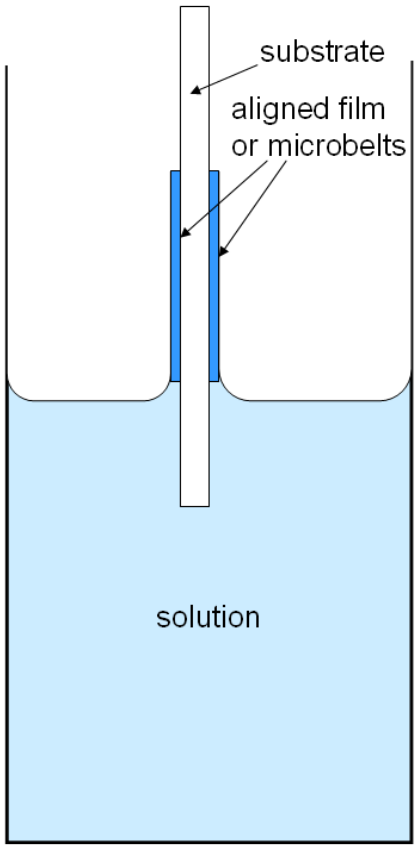

Figure S6. Schematic presentation of solution processed aligned microbelts or film in this work.

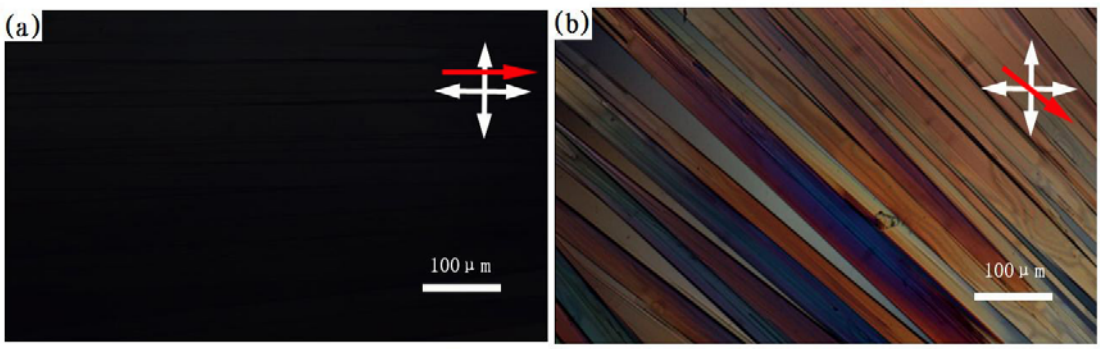

Figure S7. POM images of solution processed aligned microbelts of BOXD-T3 on glasses. White crossed arrows illustrated the crossed-polarizers and red arrow illustrated the direction of the aligned microbelts.

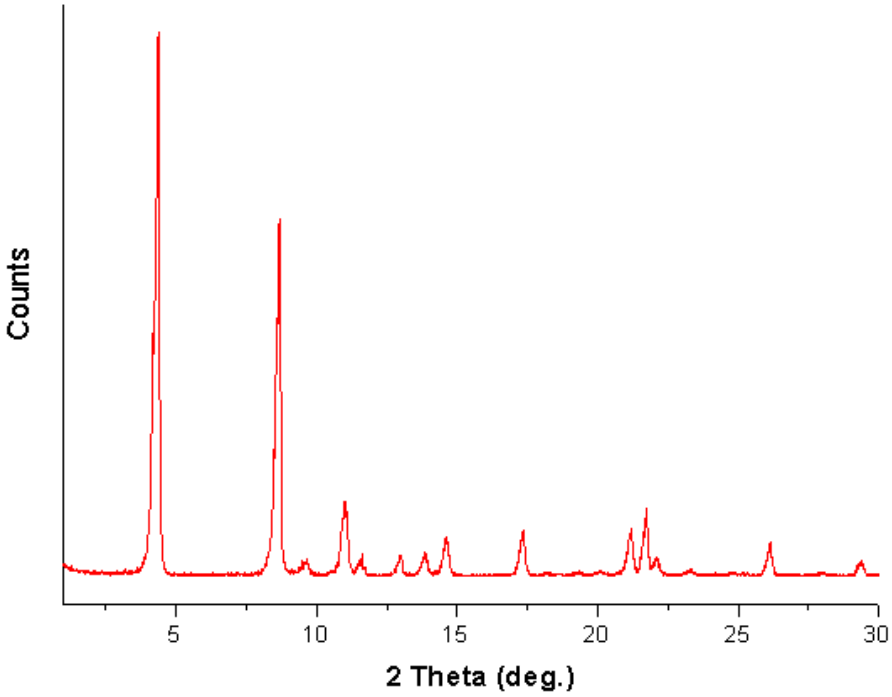

Figure S8. XRD profile of BOXD-T3 solution processed film.

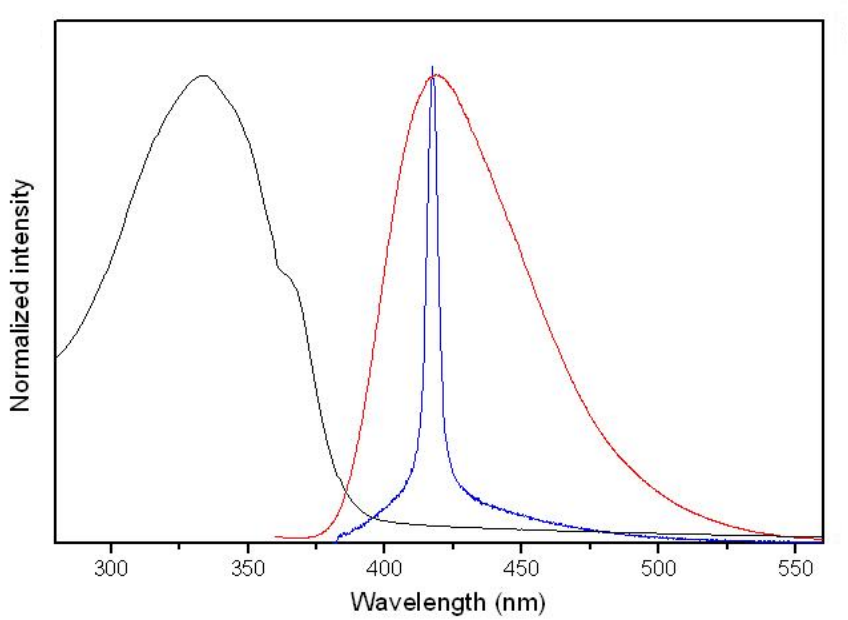

Figure S9. Normalized absorption (black), PL (red) and ASE (blue) spectra of BOXD-T3 in solution processed aligned ordered film.

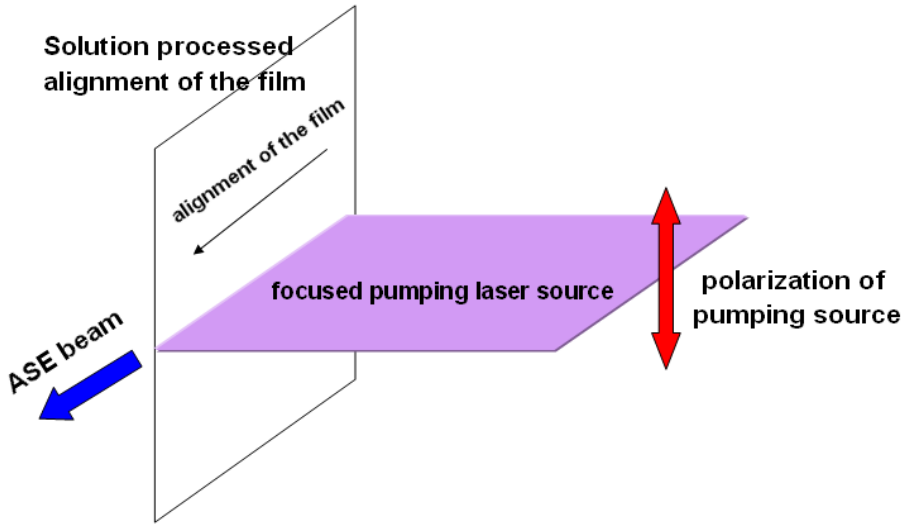

Figure S10. Schematic presentation of optical pumping experiment on BOXD-T3 solution processed aligned film.