

Supporting Information

Novel photoluminescent chiral liquid crystalline oligomers containing lanthanide ions

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2.3.1. Cholesteryl 4-(allyloxy)benzoate (M_1).

M_1 was prepared according to previously reported synthesis method.²⁸ Yield: 76%. IR (KBr): 3070 cm^{-1} (=CH), 2974, 2856 cm^{-1} ($-\text{CH}_3$, $-\text{CH}_2-$), 1706 cm^{-1} (C=O), 1642 cm^{-1} (C=C), 1604, 1498 cm^{-1} (Ar-), 1274, 1172 cm^{-1} (C-O-C). Found: C, 81.18, H, 9.87%. Calc. for $\text{C}_{37}\text{H}_{54}\text{O}_3$: C, 81.27, H, 9.95%. ^1H NMR (600 MHz, CDCl_3 , δ): 7.99–7.98 (d, $J=9$ Hz, 2H, Ar-H), 6.92 (d, $J=9$ Hz, 2H, Ar-H), 6.05 (m, 1H, $\text{CH}_2=\text{CH}-$), 5.44–5.41 (t, 2H, $\text{CH}_2=\text{CH}-$), 5.32–5.31 (m, 1H, =CH-in cholesteryl), 4.59–4.58 (d, $J=4.8$ Hz, 2H, $-\text{CH}_2\text{O}-$), 2.03–0.67 (m, 44H, cholesteryl-H).

2.3.2. 4-(((6-((4'-((4-(allyloxy)benzoyl)oxy)-[1,1'-biphenyl]-4-yl)oxy)-6-oxohexanoyl)oxy)hexahydrofuro[3,2-b]furan-3-yl)oxy)carbonyl)benzoic acid (M_2).

The intermediate 6-((4'-((4-(allyloxy) benzoyl)oxy)-[1,1'-biphenyl]-4-yl)oxy)-6-oxohexanoic acid (1) was synthesized via previously published method.²⁹ Sulfoxide chloride (20 ml) was added to compound (1) (18.98 g, 0.04 mol) at room temperature. The reaction mixture was stirred at room temperature for 2h and then 55 °C for 8 h. Vacuum distillation to remove excess of sulfoxide chloride and obtain the compound (2). Isosorbide (11.69 g, 0.08 mol) was dissolved in 100 ml THF and 6 ml Py at room temperature to obtain the solution. Compound 2 was dissolved in 150 ml THF and

then added dropwise to the solution at room temperature. The reaction mixture was stirred at 40 °C for 12 h. The mixture was poured into 1,000 ml cold water. The precipitated crude product was filtered, boiled in water and recrystallized in alcohol, isolated by filtration, and dried at 45 °C in a vacuum oven to obtain white compound (3) of 4'-((4-(allyloxy)benzoyl)oxy)-[1,1'-biphenyl]-4-yl(6-hydroxyhexahydrofuro[3,2-b]furan-3-yl)adipate. Yield: 68 %. IR (KBr): 3053 cm^{-1} (=CH), 2940, 2869 cm^{-1} ($-\text{CH}_3$, $-\text{CH}_2-$), 1757, 1743, 1728 cm^{-1} (C=O), 1650 cm^{-1} (C=C), 1606, 1496 cm^{-1} (Ar-). Found: C, 67.64, H, 5.65%. Calc. for $\text{C}_{34}\text{H}_{34}\text{O}_{10}$: C, 67.76, H, 5.69%. Terephthalic acid (5.32 g, 0.032 mol), DCC (4.95 g, 0.024 mol) and DMAP (0.48 g, 3.93 mmol) were dissolved in 150 ml THF at room temperature and stirred for 2 h to obtain the suspension liquid. Compound (3) (9.64 g, 0.016 mol) was dissolved in 80 ml THF at room temperature and then added dropwise to the suspension liquid at room temperature. The reaction mixture was stirred at room temperature for 48 h. After that, 0.15 ml water was added to the mixture at room temperature. After 2 h, the mixture was filtered and poured into 1000 ml cold water. The precipitated crude product was filtered, washed with 2% NaOH solution several times and boiled in THF, isolated by filtration, and dried at 45 °C in a vacuum oven to obtain white products M_2 . Yield: 56%. IR (KBr): 3068 cm^{-1} (=CH), 2945, 2855 cm^{-1} ($-\text{CH}_3$, $-\text{CH}_2-$), 1741, 1723, 1688 cm^{-1} (C=O), 3200–2500 cm^{-1} ($-\text{OH}$), 1649 cm^{-1} (C=C), 1604, 1492 cm^{-1} (Ar-). Found: C, 67.06, H, 5.14%. Calc. for $\text{C}_{42}\text{H}_{38}\text{O}_{13}$: C, 67.19, H, 5.10%. ^1H NMR (600 MHz, CDCl_3 , δ): 8.17–7.00 (m, 16H, Ar-H), 6.10–6.04 (m, 1H, $\text{CH}_2=\text{CH}-$), 5.47–5.33 (m, 2H, $\text{CH}_2=\text{CH}-$), 5.23–3.83 (m, 10H, $-\text{CH}_2-\text{O}-$ and $-\text{CH}-\text{O}-$), 2.62–2.40 (m, 4H, -

$\text{OOCCH}_2(\text{CH}_2)_2\text{CH}_2\text{COO}^-$, 1.82–1.77 (m, 4H, $-\text{OOCCH}_2(\text{CH}_2)_2\text{CH}_2\text{COO}^-$).

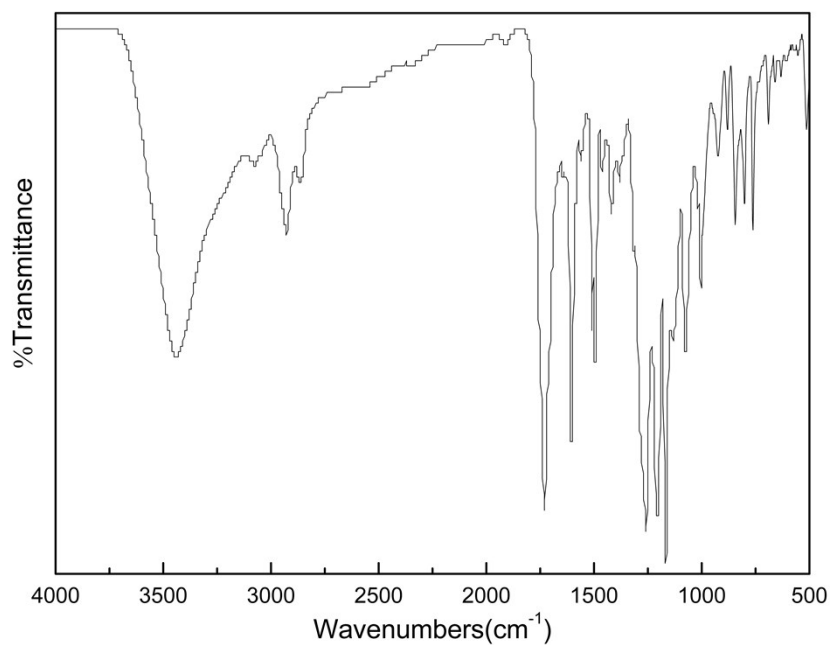


Figure S1. FT-IR spectrogram of compound(3)

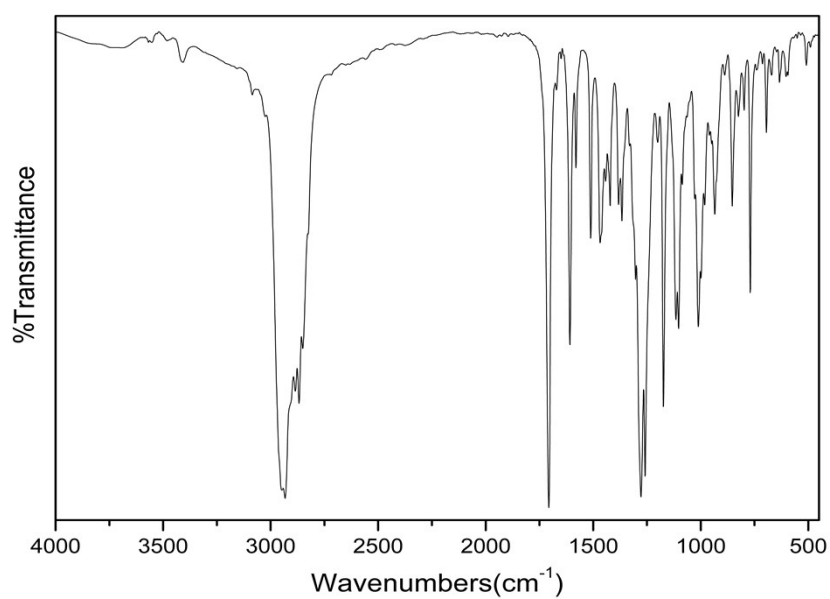


Figure S2. FT-IR spectrogram of M_1

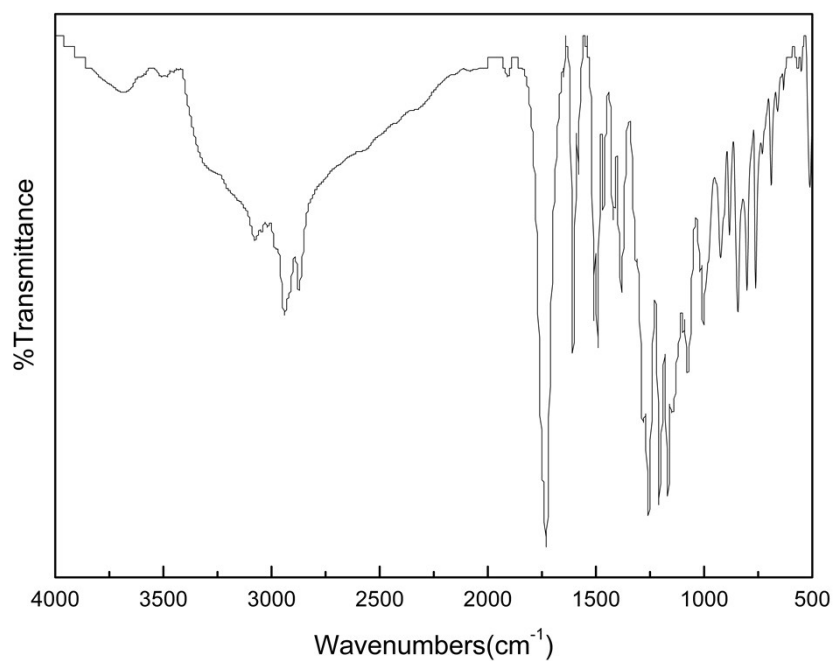


Figure S3. FT-IR spectrogram of M₂

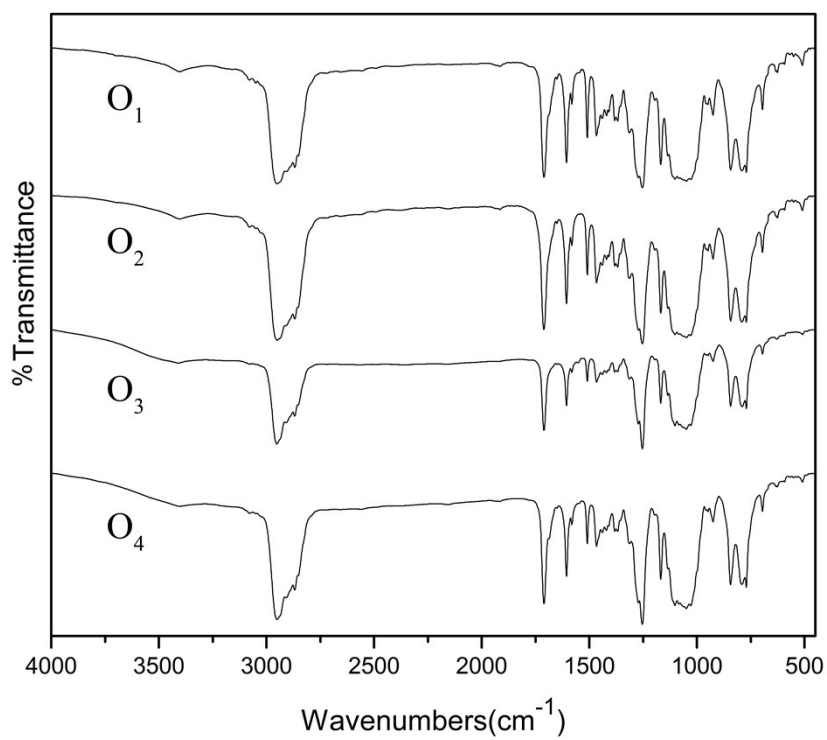


Figure S4. FT-IR spectrogram of LCOs

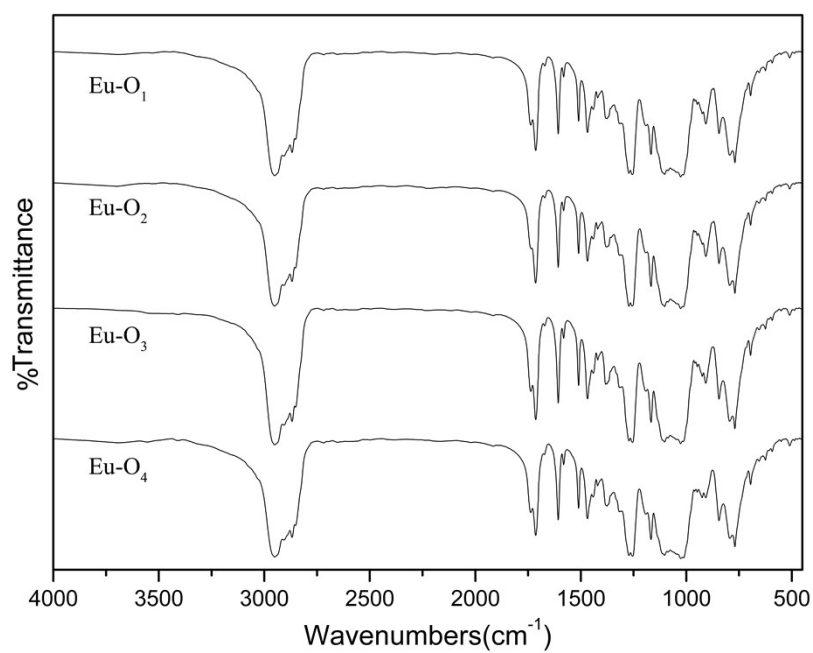


Figure S5. FT-IR spectrogram of **Eu-LCOs**

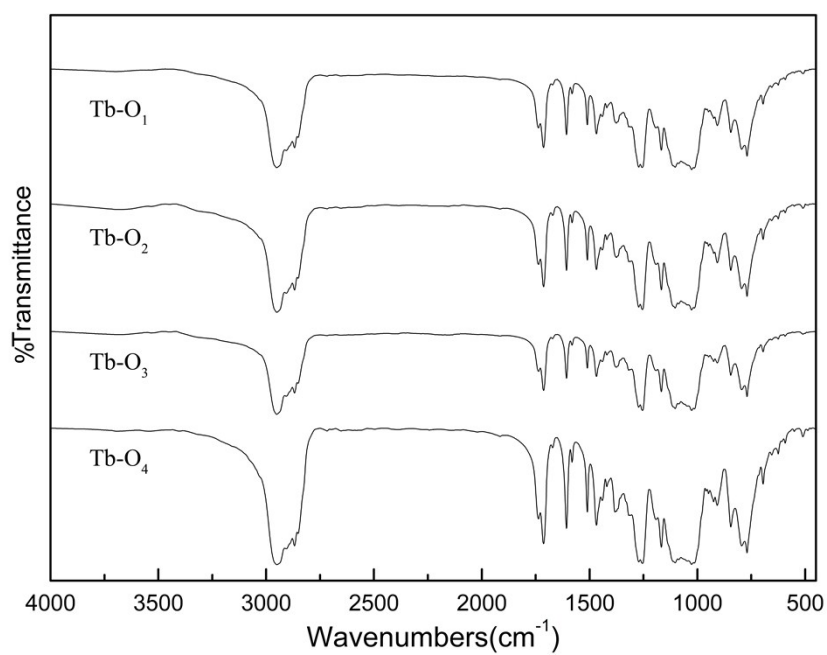


Figure S6. FT-IR spectrogram of **Tb-LCOs**

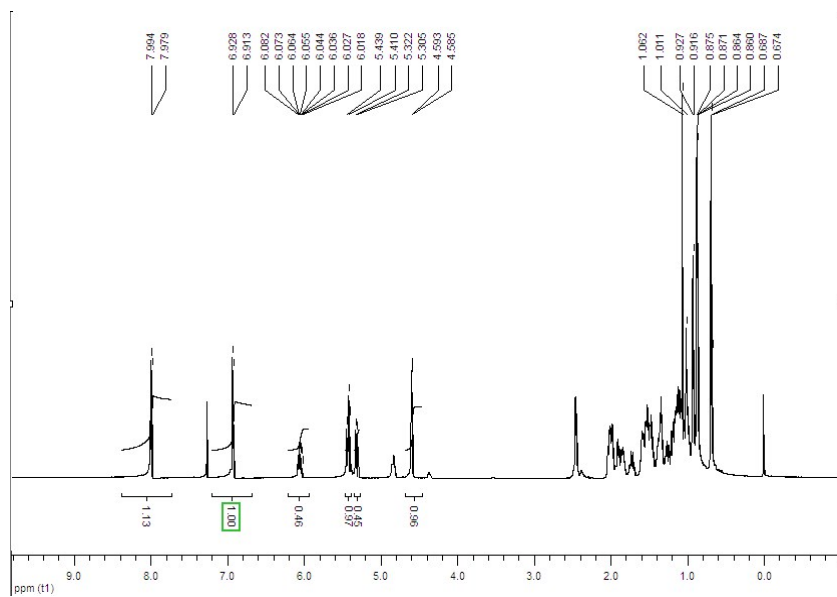


Figure S7. ^1H NMR spectrum of M_1 (600 MHz, CDCl_3).

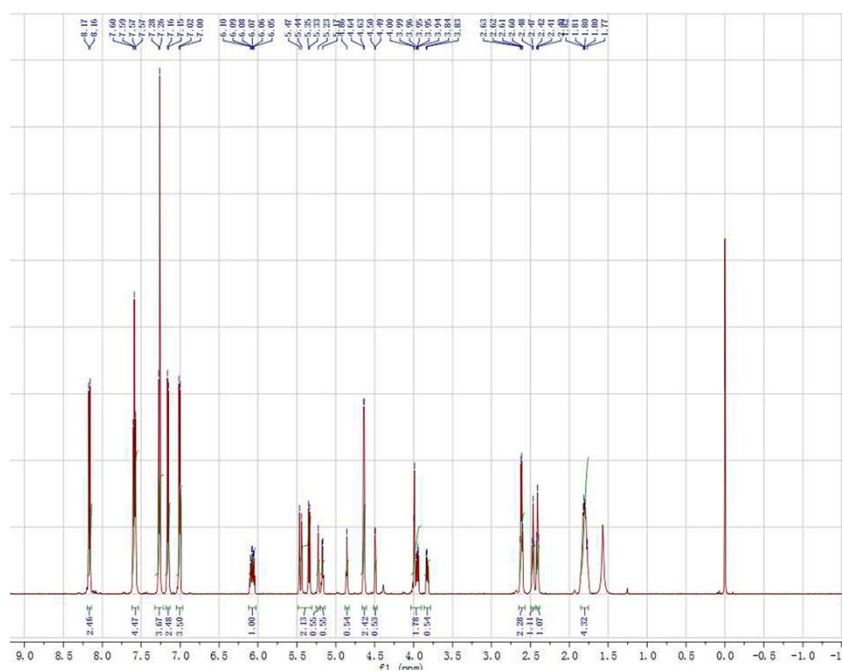


Figure S8. ^1H NMR spectrum of M_2 (600 MHz, CDCl_3).

Table 4 Specific rotations of M₁, M₂ and oligomers

Sample	Concentration (g/L)	solvent	reference fluid	Specific rotations
O ₁	0.2	TOL	TOL	-7.36
O ₂	0.2	TOL	TOL	-5.84
O ₃	0.2	TOL	TOL	-4.28
O ₄	0.2	TOL	TOL	-3.06
Tb-O ₁	0.2	TOL	TOL	-7.29
Tb-O ₂	0.2	TOL	TOL	-5.78
Tb-O ₃	0.2	TOL	TOL	-4.21
Tb-O ₄	0.2	TOL	TOL	-2.97
Eu-O ₁	0.2	TOL	TOL	-7.31
Eu-O ₂	0.2	TOL	TOL	-5.76
Eu-O ₃	0.2	TOL	TOL	-4.24
Eu-O ₄	0.2	TOL	TOL	-2.99
M ₁	0.2	TOL	TOL	-5.40
M ₂	0.2	TOL	TOL	+12.63

References

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