

Electronic Supplementary Information

Chiral Surfactants for Dispersing Carbon Nanotubes

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1. Synthesis of chiral surfactants ACSLCOs

Monomer 1 (M1) cholesteryl 4-(allyloxy)benzoate was synthesized according to reference,¹ it showed the following phase transition: Crystalline (112 °C), chiral nematic (240 °C), and isotropic fluid, the detailed chemical parameters of M1 were as follows, IR (KBr): 3056 (=CH), 2973-2857 (CH₃, CH₂), 1704 (C=O), 1643 (C=C), 1605 (Ar), 1494 (Ar), 1273 (C-O-C), 1171 (C-O-C), ¹H NMR (600 MHz, CDCl₃, δ): 7.99-7.98 (d, 2H, Ar-H), 6.92 (d, 2H, Ar-H), 6.05 (m, 1H, CH₂=CH-), 5.44-5.41 (t, 2H, CH₂=CH-), 5.32-5.31 (m, 1H, =CH- in cholesteryl), 4.59-4.58 (d, 2H, -OCH₂-), 2.03-0.67 (m, 44H, cholesteryl-H). Monomer 2 (M2) cholesteryl acrylate was synthesized by a similar procedure with M1, it showed the following phase transition: Crystalline (84.69 °C), chiral nematic (120.19 °C), and isotropic fluid, the detailed chemical parameters of M2 were as follows, IR (KBr): 2950-2845 (CH₃, CH₂), 1701 (C=O), 1620 (C=C), 1447 (Ar), 1282 (C-O-C), 1195 (C-O-C), ¹H NMR (600 MHz, CDCl₃, δ): 6.40-5.78 (m, 2H, CH₂=CH-), 6.12-6.07 (m, 1H, CH₂=CH-), 5.38 (m, 1H, =CH- in cholesteryl), 3.77-3.74 (t, 1H, -COOCH- in cholesteryl), 1.64-0.67 (m, 43H, cholesteryl-H). Monomer 3 (M3) N-(2'-chloro-6'-(diethylamino)-3'-Methyl-3-oxo-3H-spiro[isobenzofuran-1,9'-xanthene]-5-yl)undec-10-enamide was synthesized according to references,^{2,3} it showed the following phase transition: Crystalline (71 °C), and isotropic fluid, the detailed chemical parameters of M3 were as follows, IR (KBr): 3318(NH), 3048 (=CH), 2960-2840 (CH₃, CH₂), 1754, 1735 (C=O), 1660 (C=C), 1184 (C-O-C), ¹H NMR (600 MHz, CDCl₃, δ): 1.158

(m, 8H, (CH₂)₄), 1.250 (t, 6H, 2CH₃), 1.686 (m, 2H, -CH₂CH₂(CH₂)₄-), 2.007 (m, 2H, -CH₂CH₂-CH=), 2.421 (q, 3H, -CH₃-Ar), 3.342 (q, 4H, -N(CH₂)₂), 4.940 (m, 2H, -CH=CH₂), 5.789 (m, 1H, -CH=CH₂), 6.350 (s, 1H, -Ar), 6.426 (d, 1H, -Ar), 6.590 (s, 1H, -Ar), 6.749 (d, 1H, -Ar), 7.132 (m, 1H, -Ar), 7.352 (m, 1H, -Ar), 8.180 (s, 1H, -NH), 8.290 (m, 1H, -Ar), 8.720 (s, 1H, -Ar). The series of amphiphilic chiral side-chain liquid crystalline polymers (ACSLCOs) were synthesized according to reference.⁴ M1, M2 and M3 were added to polymethylhydrogensiloxane (PMHS, Aldrich). After the addition of platinum catalyst, the polymerization was carried out at 80 °C under nitrogen protection with magnetic stirring until the infrared spectra showed no Si-H absorption peak at 2166cm⁻¹.⁵

2. The detailed information about S4820

2.1. Composition analysis

The CLC S4820 (left-handed, T_c=68.3°C, purchased from Shijiazhuang Chengzhi Yonghua Display Materials Co, Ltd) consists of S811 and commercial nematic LC 4820.

2.1.1. S811 is a widely used left-handed chiral dopant, the molecular structure of S811 is shown in Fig. S1

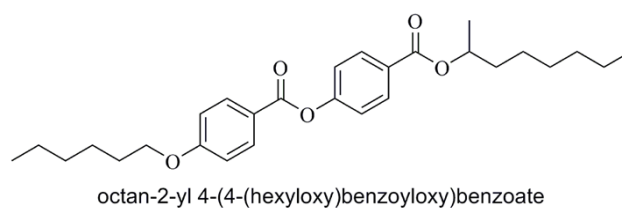


Fig. S1 The molecular structure of S811

2.1.2. Nematic LC 4820 is a kind of mixture (milky fluid), the polarized optical textures of nematic LC 4820 are shown in Fig.S2 (a, b, c).

2.1.3. CLC S4820 is a kind of mixture (red fluid), the polarized optical textures of are listed in Fig. S2 (d, e, f).

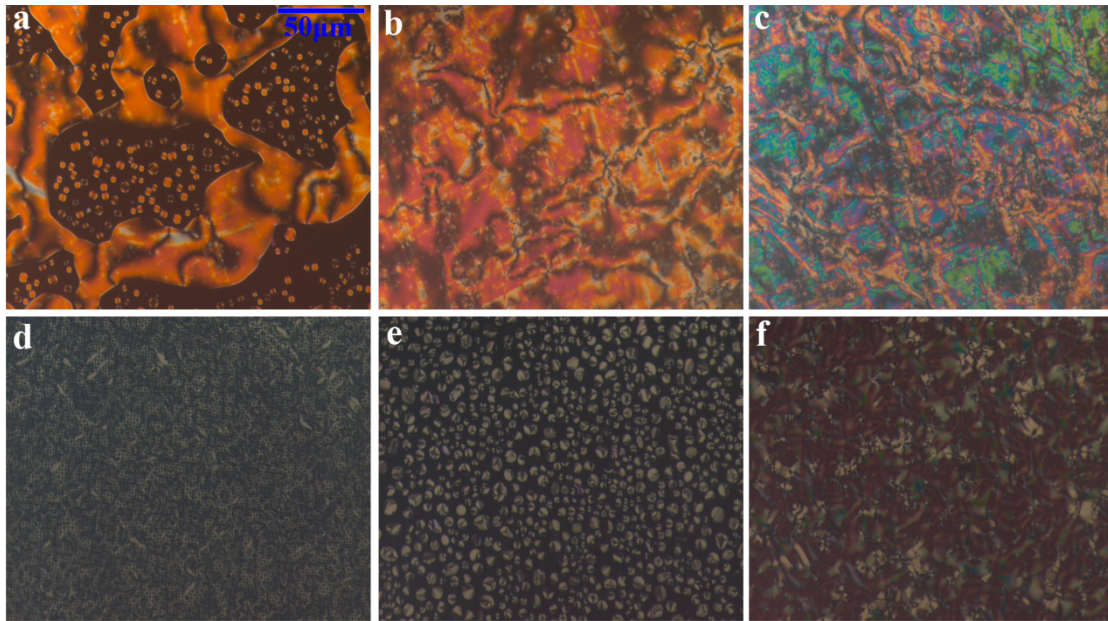


Fig. S2- Optical textures of 4820 (a-c), a (heating to 112 °C) , b (cooling to 108 °C) , c (cooling to 80 °C) and optical textures of CLC (d-f), a (heating to 50 °C) , b (cooling to 60 °C) , c (cooling to 40 °C) (crossed polarizers, 200×).

2.2. Appropriateness of side-chains on the oligomers

As shown in Table 1 in the main article, the specific rotation of ACSLCO is negative, that is to say, the side-chains on the Si-O backbone make ACSLCO become a left-handed material. Meanwhile, CLC S4820 is also a left-handed material as mentioned above, this means the side-chains used on the oligomers are appropriate.

3. The reasons for the necessary of M1 and M2

3.1. The reasons for using M1 are that M1 has wide liquid crystalline range (from 112 °C to 240 °C) and the chemical structure possesses high stability for lack of reactive functional groups. The extra spacer in M1 is used to broaden the liquid crystalline range of M1.

3.2. The reasons for using M2 are as following,

There is no benzene ring in the molecular structure of M2 compared with M1, the main purpose of using M2 is to bring some flexibility to ACSLCO and to reduce the viscosity of ACSLCO.

Meanwhile, M2 has the same chiral unit (cholesterol group) as M1, which makes R2 have good compatibility with R1.

Based on the above analysis, both M1 and M2 are necessary in this study.

Table S1. Concentrations (mg ml⁻¹) of CNTs in CNT-ACSLCO dispersions determined by FTIR spectrum and UV-Vis-NIR spectrum.

Samples	CNT-O1	CNT-O2	CNT-O3	CNT-O4	CNT-O5	CNT-O6	CNT-O7
IR concentration	<0.05	<0.05	<0.05	0.05~0.1	0.1~0.3	0.5~0.7	0.7~0.9
UV concentration	0.017	0.026	0.046	0.092	0.26	0.68	0.85
Match	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table S2. Tg data of ACSLCOs and CNT-ACSLCO composites

Samples	O1	O2	O3	O4	O5	O6	O7
Neat ACSLCO	28.38	27.27	25.03	24.39	23.24	22.78	21.48
CNT-ACSLCO	12.82	11.81	11.07	10.65	10.09	9.21	-

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