

## Supplementary Information

### Novel D- $\pi$ -A and A- $\pi$ -D- $\pi$ -A Three-Component Photoinitiating Systems Based on Carbazole/Triphenylamino based Chalcones and Application in 3D and 4D Printing

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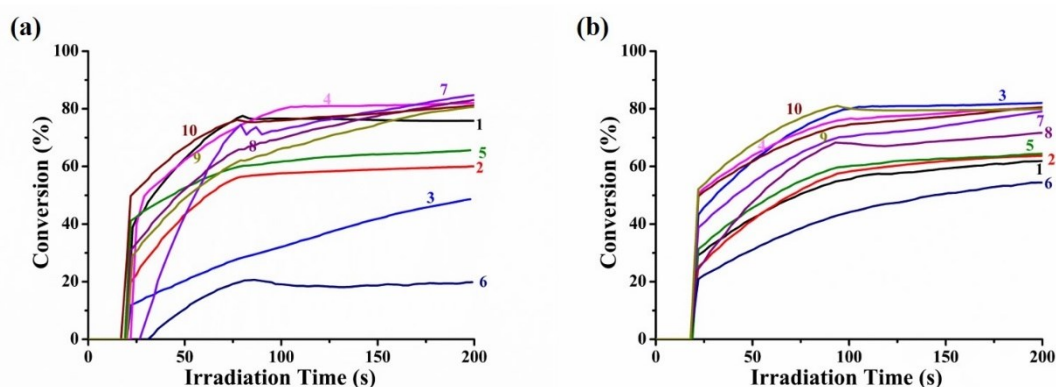
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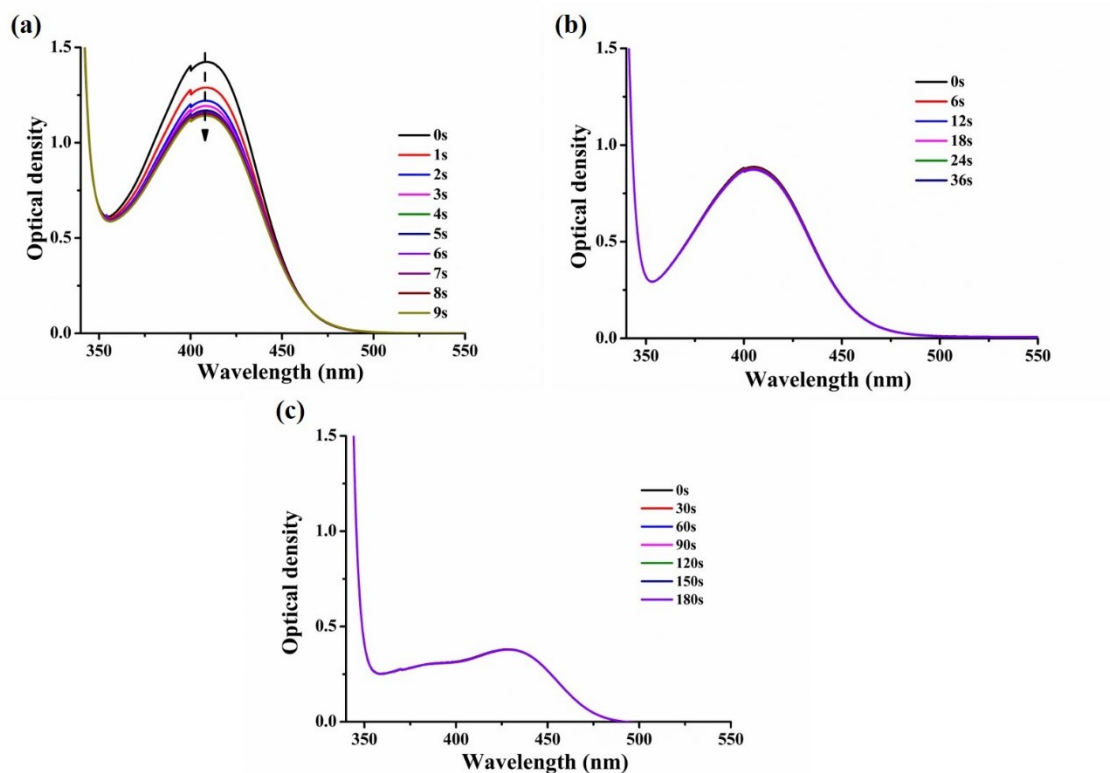
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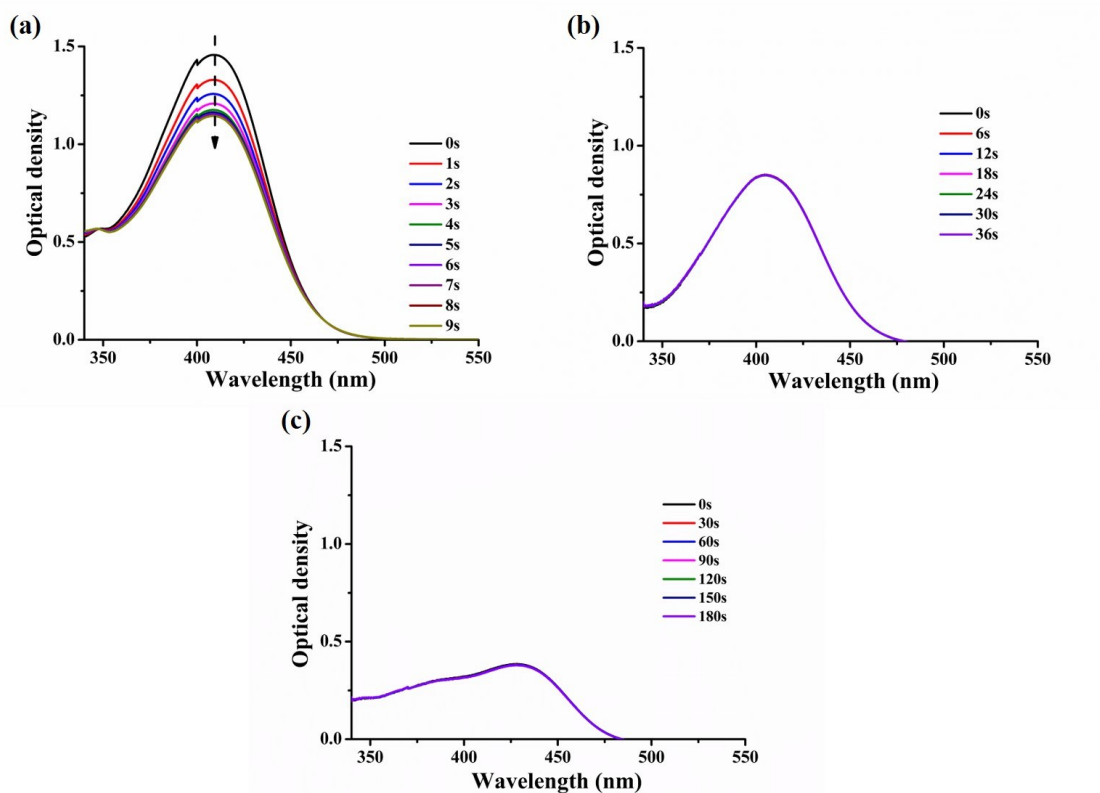
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pu.xiao@anu.edu.au (P. X.).



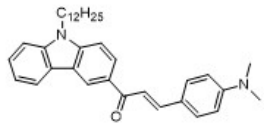
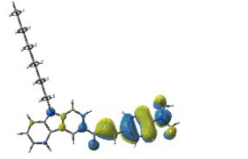
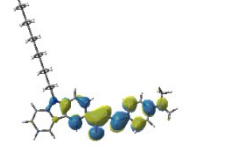
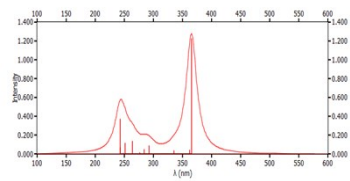
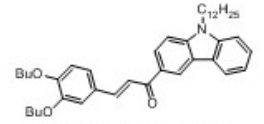
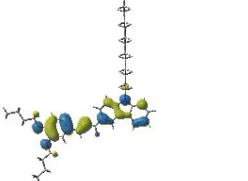
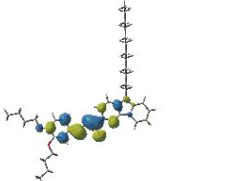
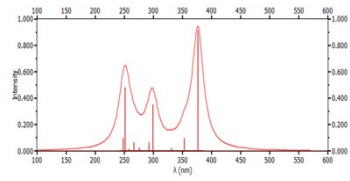
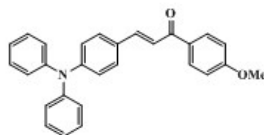
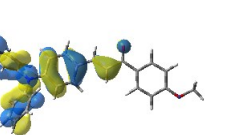
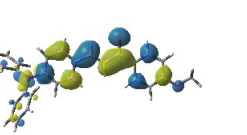
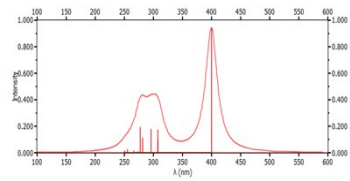
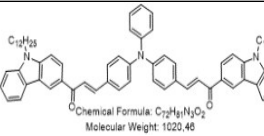
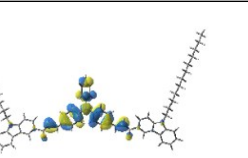
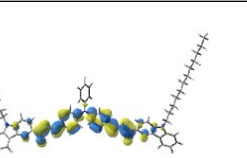
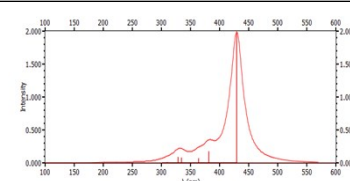
**Figure S1.** Photopolymerization profiles of PEG-acrylate (conversion rate of C=C bonds vs irradiation time) upon exposure to a LED@405nm in laminate, initiated by chalcones 1-10 in the presence of (a) amine (Speedcure EDB); (b) without any additive, at the same weight ratio chalcones 1-10: EDB=1.5%:1.5% in PEG-diacrylate in thin films, the irradiation starts from  $t = 20$ s.



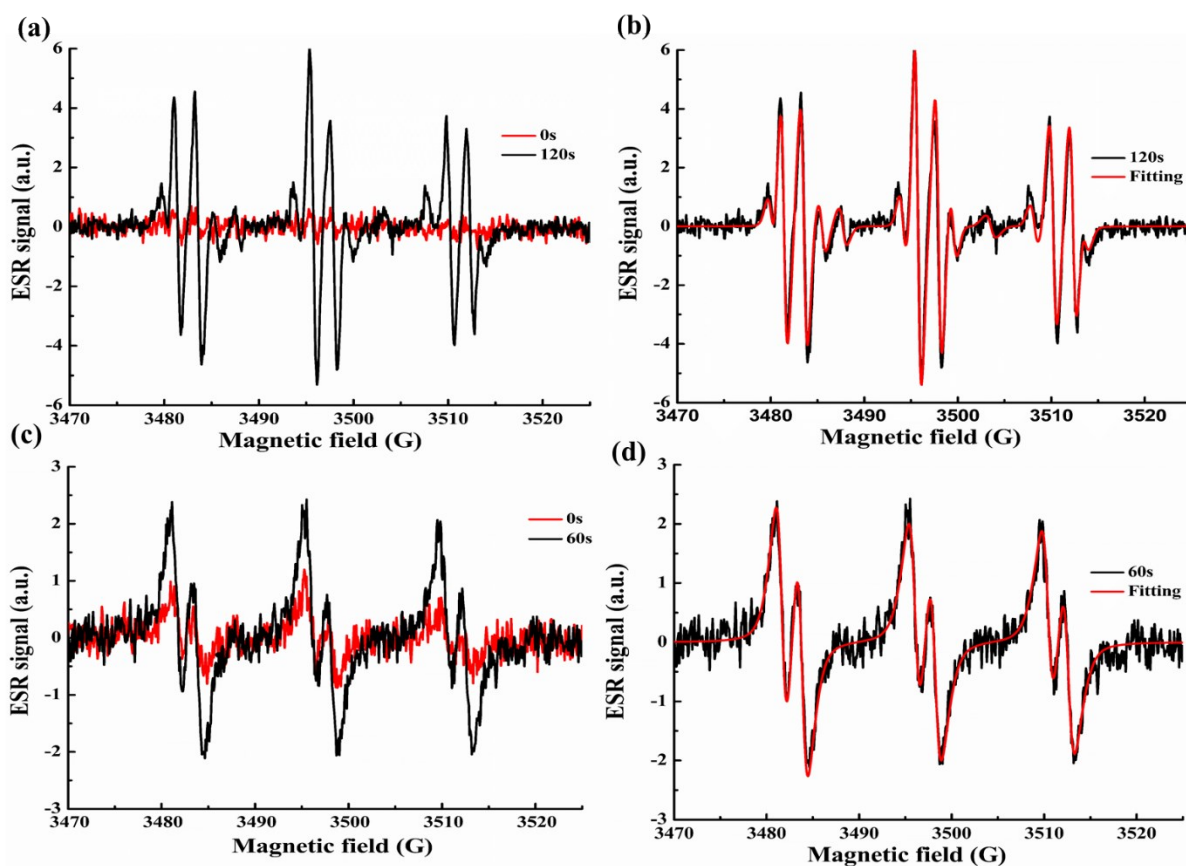
**Figure S2.** Photolysis of chalcones ( $5 \times 10^{-5}$  M in acetonitrile) only in the presence of amine (Speedcure EDB, 0.01 M) upon exposure to LED@405nm under air in the solvent of acetonitrile: (a) chalcone 4; (b) chalcone 7; (c) chalcone 10.



**Figure S3.** Photolysis of chalcones ( $5 \times 10^{-5}$  M in acetonitrile) upon exposure to LED@405nm under air in the solvent of acetonitrile: (a) chalcone 4; (b) chalcone 7; (c) chalcone 10.

Chalcone	HOMO	LUMO	Calculated UV spectra	$E_T$ (kcal mol <sup>-1</sup> )
 <p>Chemical Formula: C<sub>35</sub>H<sub>44</sub>N<sub>2</sub>O Molecular Weight: 508.75</p> <p>Chalcone 4</p>			 <p><math>\lambda_{\max} = 366</math> nm F= 1.228</p>	48.84
 <p>Chemical Formula: C<sub>41</sub>H<sub>53</sub>NO<sub>3</sub> Molecular Weight: 609.8950</p> <p>Chalcone 5</p>			 <p><math>\lambda_{\max} = 366</math> nm F= 1.228</p>	46.84
 <p>Chemical Formula: C<sub>28</sub>H<sub>23</sub>NO<sub>2</sub> Molecular Weight: 405.4970</p> <p>Chalcone 7</p>			 <p><math>\lambda_{\max} = 400</math> nm F= 0.940</p>	47.08
 <p>Chemical Formula: C<sub>72</sub>H<sub>61</sub>N<sub>2</sub>O<sub>2</sub> Molecular Weight: 1020.46</p> <p>Chalcone 10</p>			 <p><math>\lambda_{\max} = 430</math> nm F= 1.975</p>	47.33

**Figure S4.** Contour plots of HOMOs and LUMOs for chalcones 4, 5, 7 and 10; structures optimized at the B3LYP/6-31G\* level of theory.



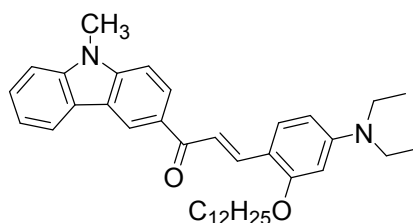
**Figure S5.** ESR spectra obtained from ESR-spin trapping experiment using PBN = 2 mg/mL (as spin trap agent); amine (Speedcure EDB) = 12.6 mg/mL and chalcone 4 = 0.8 mg/mL in *tert*-butylbenzene under N<sub>2</sub>. (a) chalcone 4/EDB Irradiation time = 0 s (red) and = 120 s (black) spectra; (b) chalcone 4/EDB Irradiation time = 120 s experimental (black) and fitting (red) spectra; (c) chalcone 4 alone Irradiation time = 0 s (red) and = 60 s (black) spectra; (d) chalcone 4 alone Irradiation time = 60 s experimental (black) and fitting (red) spectra.

## Synthesis of Chalcones 1-10

### General information

All reagents and solvents were purchased from Aldrich or Alfa Aesar and used as received without further purification. High resolution Mass spectroscopy (HRMS) was performed by the Spectropole of Aix-Marseille University. ESI mass spectral analyses were recorded with a 3200 QTRAP (Applied Biosystems SCIEX) mass spectrometer. The HRMS mass spectral analysis was performed with a QStar Elite (Applied Biosystems SCIEX) mass spectrometer. Elemental analyses were recorded with a Thermo Finnigan EA 1112 elemental analysis apparatus driven by the Eager 300 software.  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectra were determined at room temperature in 5 mm o.d. tubes on a Bruker Avance 400 spectrometer of the Spectropole:  $^1\text{H}$  (400 MHz) and  $^{13}\text{C}$  (100 MHz). The  $^1\text{H}$  chemical shifts were referenced to the solvent peaks DMSO (2.49 ppm),  $\text{CDCl}_3$  (7.26 ppm) and the  $^{13}\text{C}$  chemical shifts were referenced to the solvent peak DMSO (49.5 ppm),  $\text{CDCl}_3$  (77.0 ppm). All photoinitiators were prepared with analytical purity up to accepted standards for new organic compounds (>98%), which were checked by high field NMR analysis.

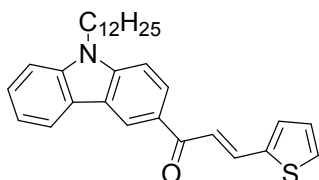
Synthesis of (*E*)-3-(4-(diethylamino)-2-(dodecyloxy)phenyl)-1-(9-methyl-9*H*-carbazol-3-yl)prop-2-en-1-one (**chalcone 1**)



4-(Diethylamino)-2-(dodecyloxy)benzaldehyde (3.62g, 10 mmol,  $M = 361.57$  g/mol) and 1-(9-methyl-9*H*-carbazol-3-yl)ethan-1-one (2.23 g, 10 mmol,  $M = 223.28$  g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of  $\text{SiO}_2$  using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (4.42 g, 78% yield).  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$ : 8.84 (d,  $J = 1.4$  Hz, 1H), 8.24 (dd,  $J = 8.6, 1.7$  Hz, 1H), 8.17 (d,  $J = 7.7$  Hz,

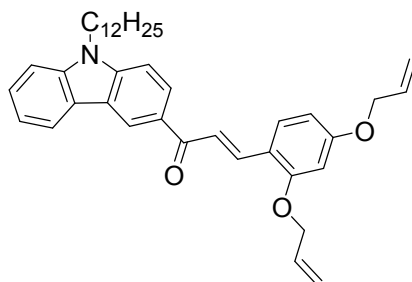
1H), 8.10 (d,  $J = 15.5$  Hz, 1H), 7.81 (d,  $J = 15.5$  Hz, 1H), 7.51 (m, 2H), 7.42 (dd,  $J = 8.4, 2.0$  Hz, 2H), 7.29 (dt,  $J = 11.6, 2.3$  Hz, 1H), 6.32 (dd,  $J = 8.7, 2.4$  Hz, 1H), 6.17 (d,  $J = 2.3$  Hz, 1H), 4.07 (t,  $J = 6.5$  Hz, 2H), 3.89 (s, 3H), 3.42 (q,  $J = 7.1$  Hz, 4H), 2.02 – 1.91 (m, 2H), 1.63 – 1.52 (m, 2H), 1.43 – 1.20 (m, 16H), 1.23 (t,  $J = 7.1$  Hz, 6H), 0.87 (t,  $J = 7.0$  Hz, 3H);  $^{13}\text{C}$  NMR (101 MHz,  $\text{CDCl}_3$ )  $\delta$  190.56, 160.82, 150.91, 143.42, 141.81, 141.09, 132.60, 131.14, 126.87, 126.33, 123.47, 122.72, 121.74, 120.70, 119.89, 117.97, 112.51, 108.96, 108.10, 104.49, 95.08, 68.38, 44.78, 32.05, 29.78, 29.77, 29.75, 29.69, 29.67, 29.47, 29.41, 26.49, 22.82, 14.24, 12.89; HRMS (ESI MS)  $m/z$ : theor: 567.3945 found: 567.3947 ( $[\text{M}+\text{H}]^+$  detected).

Synthesis of (*E*)-1-(9-dodecyl-9*H*-carbazol-3-yl)-3-(thiophen-2-yl)prop-2-en-1-one (**chalcone 2**)



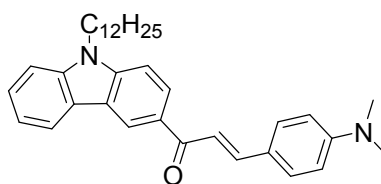
Thiophene-2-carbaldehyde (1.12 g, 10 mmol,  $M = 112.14$  g/mol) and 1-(9-dodecyl-9*H*-carbazol-3-yl)ethan-1-one (3.77 g, 10 mmol,  $M = 377.57$  g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of  $\text{SiO}_2$  using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (4.06 g, 86% yield).  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  8.82 (d,  $J = 1.6$  Hz, 1H), 8.24 – 8.18 (m, 2H), 8.02 (d,  $J = 15.3$  Hz, 1H), 7.58 (d,  $J = 15.3$  Hz, 1H), 7.54 – 7.49 (m, 1H), 7.44 (d,  $J = 8.7$  Hz, 2H), 7.40 (dd,  $J = 14.0, 4.4$  Hz, 2H), 7.34 – 7.29 (m, 1H), 7.10 (dd,  $J = 5.0, 3.6$  Hz, 1H), 4.31 (t,  $J = 7.2$  Hz, 2H), 1.94 – 1.83 (m, 2H), 1.42 – 1.20 (m, 18H), 0.89 (t,  $J = 6.9$  Hz, 3H);  $^{13}\text{C}$  NMR (101 MHz,  $\text{CDCl}_3$ )  $\delta$  188.93, 143.35, 141.27, 140.98, 136.12, 131.58, 129.56, 128.38, 128.31, 126.77, 126.53, 123.35, 122.91, 122.04, 121.45, 120.85, 120.09, 109.37, 108.62, 43.48, 32.02, 29.70, 29.66, 29.59, 29.48, 29.43, 29.06, 27.38, 22.80, 14.23; HRMS (ESI MS)  $m/z$ : theor: 472.2669 found: 472.2666 ( $[\text{M}+\text{H}]^+$  detected).

Synthesis of (*E*)-3-(2,4-bis(allyloxy)phenyl)-1-(9-dodecyl-9*H*-carbazol-3-yl) prop-2-en-1-one (**chalcone 3**)



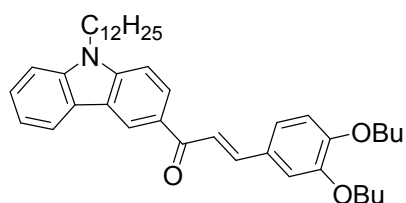
2,4-Bis(allyloxy)benzaldehyde (2.18 g, 10 mmol, M = 218.25 g/mol) and 1-(9-dodecyl-9*H*-carbazol-3-yl)ethan-1-one (3.77 g, 10 mmol, M = 377.57 g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of SiO<sub>2</sub> using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (4.56 g, 79% yield). <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.84 (d, *J* = 1.3 Hz, 1H), 8.24 (dd, *J* = 8.6, 1.4 Hz, 1H), 8.17 (dd, *J* = 11.7, 7.3 Hz, 2H), 7.88 (d, *J* = 15.7 Hz, 1H), 7.62 (d, *J* = 8.5 Hz, 1H), 7.51 (t, *J* = 7.6 Hz, 1H), 7.43 (d, *J* = 8.5 Hz, 2H), 7.31 (t, *J* = 7.3 Hz, 1H), 6.57 (dd, *J* = 8.5, 2.1 Hz, 1H), 6.53 (d, *J* = 2.1 Hz, 1H), 6.23 – 6.01 (m, 2H), 5.58 – 5.30 (m, 4H), 4.64 (d, *J* = 5.2 Hz, 2H), 4.57 (d, *J* = 5.3 Hz, 2H), 4.29 (t, *J* = 7.1 Hz, 2H), 1.87 (dd, *J* = 14.2, 7.1 Hz, 2H), 1.42 – 1.22 (m, 18H), 0.90 (t, *J* = 6.9 Hz, 3H); <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 190.18, 161.69, 159.44, 143.18, 141.29, 139.45, 133.01, 131.37, 130.29, 126.89, 126.42, 123.48, 122.81, 122.05, 121.31, 120.74, 119.97, 118.30, 118.20, 118.12, 109.38, 108.59, 106.64, 100.54, 69.47, 69.16, 43.48, 32.08, 29.76, 29.73, 29.65, 29.55, 29.50, 29.12, 27.44, 22.86, 14.29; HRMS (ESI MS) *m/z*: theor: 578.3629 found: 578.3630 ([*M*+*H*]<sup>+</sup> detected).

Synthesis of (*E*)-3-(4-(dimethylamino)phenyl)-1-(9-dodecyl-9*H*-carbazol-3-yl) prop-2-en-1-one (**chalcone 4**)



4-(Dimethylamino)benzaldehyde (1.49 g, 10 mmol, M = 149.19 g/mol) and 1-(9-dodecyl-9H-carbazol-3-yl)ethan-1-one (3.77 g, 10 mmol, M = 377.57 g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of SiO<sub>2</sub> using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (4.42 g, 87% yield). <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.84 (d, *J* = 1.5 Hz, 1H), 8.23 (dd, *J* = 8.7, 1.7 Hz, 1H), 8.20 (d, *J* = 7.7 Hz, 1H), 7.88 (d, *J* = 15.4 Hz, 1H), 7.64 – 7.60 (m, 2H), 7.59 (d, *J* = 15.4 Hz, 1H), 7.54 – 7.49 (m, 1H), 7.44 (d, *J* = 8.5 Hz, 2H), 7.33 – 7.28 (m, 1H), 6.73 (d, *J* = 8.8 Hz, 2H), 4.32 (t, *J* = 7.2 Hz, 2H), 3.04 (s, 6H), 1.94 – 1.83 (m, 2H), 1.42 – 1.23 (m, 18H), 0.89 (t, *J* = 6.9 Hz, 3H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 189.81, 151.90, 144.60, 143.09, 141.25, 130.43, 130.34, 126.75, 126.36, 123.43, 122.80, 121.85, 120.80, 119.90, 117.59, 112.12, 109.29, 108.48, 43.46, 40.32, 32.02, 29.71, 29.67, 29.60, 29.50, 29.44, 29.07, 27.39, 22.80, 14.23; HRMS (ESI MS) *m/z*: theor: 509.3526 found: 509.3537 ([M+H]<sup>+</sup> detected).

Synthesis of (*E*)-3-(3,4-dibutoxyphenyl)-1-(9-dodecyl-9H-carbazol-3-yl) prop-2-en-1-one (**chalcone 5**)

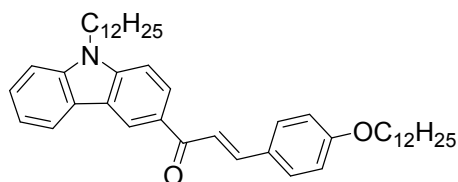


3,4-Dibutoxybenzaldehyde (2.50 g, 10 mmol, M = 250.34 g/mol) and 1-(9-dodecyl-9H-carbazol-3-yl)ethan-1-one (3.77 g, 10 mmol, M = 377.57 g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of SiO<sub>2</sub> using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (4.88 g, 80% yield). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>) δ 8.85 (d, *J* = 1.4 Hz,



1H), 8.27 – 8.18 (m, 2H), 7.84 (d,  $J = 15.5$  Hz, 1H), 7.62 (d,  $J = 15.5$  Hz, 1H), 7.57 – 7.49 (m, 1H), 7.46 (dd,  $J = 8.3, 2.3$  Hz, 2H), 7.36 – 7.25 (m, 3H), 6.93 (d,  $J = 8.1$  Hz, 1H), 4.34 (t,  $J = 7.2$  Hz, 2H), 4.10 (dt,  $J = 9.5, 6.6$  Hz, 4H), 1.96 – 1.79 (m, 6H), 1.56 (dt,  $J = 14.8, 7.5$  Hz, 4H), 1.45 – 1.23 (m, 18H), 1.02 (td,  $J = 7.4, 5.5$  Hz, 6H), 0.89 (t,  $J = 6.7$  Hz, 3H).  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ )  $\delta$  189.88, 151.67, 149.38, 144.12, 143.27, 141.28, 129.95, 128.37, 126.85, 126.51, 123.37, 123.08, 122.86, 122.08, 120.83, 120.43, 120.04, 113.33, 109.37, 108.60, 69.41, 68.98, 43.51, 32.03, 31.51, 31.36, 29.72, 29.68, 29.61, 29.51, 29.45, 29.09, 27.41, 22.81, 19.40, 19.37, 14.24, 14.04, 13.99; HRMS (ESI MS)  $m/z$ : theor: 610.9025 found: 610.9028 ( $[\text{M}+\text{H}]^+$  detected).

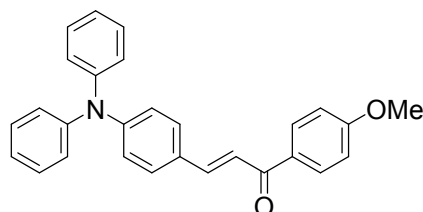
Synthesis of (*E*)-1-(9-dodecyl-9*H*-carbazol-3-yl)-3-(4-(dodecyloxy)phenyl) prop-2-en-1-one (**chalcone 6**)



4-(Dodecyloxy)benzaldehyde (2.90 g, 10 mmol,  $M = 290.45$  g/mol) and 1-(9-dodecyl-9*H*-carbazol-3-yl)ethan-1-one (3.77 g, 10 mmol,  $M = 377.57$  g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of  $\text{SiO}_2$  using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (5.33 g, 82% yield).  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  8.84 (d,  $J = 1.5$  Hz, 1H), 8.23 (dd,  $J = 8.7, 1.7$  Hz, 1H), 8.20 (d,  $J = 7.7$  Hz, 1H), 7.87 (d,  $J = 15.5$  Hz, 1H), 7.68 – 7.62 (m, 3H), 7.57 – 7.48 (m, 1H), 7.44 (d,  $J = 8.5$  Hz, 2H), 7.34 – 7.28 (m, 1H), 6.95 (d,  $J = 8.8$  Hz, 2H), 4.32 (t,  $J = 7.2$  Hz, 2H), 4.01 (t,  $J = 6.6$  Hz, 2H), 1.93 – 1.85 (m, 2H), 1.85 – 1.77 (m, 2H), 1.51 – 1.22 (m, 36H), 0.89 (dt,  $J = 7.0, 4.7$  Hz, 6H).  $^{13}\text{C}$  NMR (101 MHz,  $\text{CDCl}_3$ )  $\delta$  189.69, 161.21, 143.66, 143.26, 141.28, 130.22, 130.18, 129.98, 128.00, 126.82, 126.48, 123.40, 122.87, 122.03, 120.82, 120.15, 120.02, 115.04, 109.35, 108.59, 68.34, 43.49, 34.26, 32.06, 32.04, 29.80, 29.78, 29.74, 29.72, 29.68, 29.61, 29.53, 29.50, 29.49, 29.45, 29.34, 29.08,

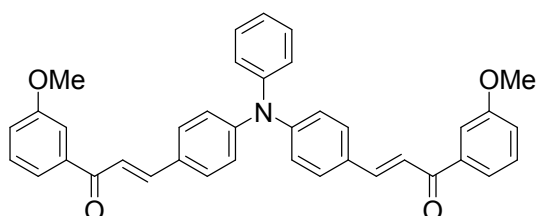
27.40, 26.16, 22.82, 22.81, 22.46, 14.24, 14.23, 14.17; HRMS (ESI MS) m/z: theor: 650.4932 found: 650.4933 ( $[M+H]^+$  detected).

Synthesis of (*E*)-3-(4-(diphenylamino)phenyl)-1-(4-methoxyphenyl)prop-2-en-1-one (**chalcone 7**)



4-(Diphenylamino)benzaldehyde (2.73 g, 10 mmol,  $M = 273.33$  g/mol) and 4'-methoxyacetophenone (1.50 g, 10 mmol,  $M = 150.18$  g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of  $SiO_2$  using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (2.59 g, 64% yield).  $^1H$  NMR (400 MHz, DMSO)  $\delta$  8.15 – 8.09 (m, 2H), 7.77 – 7.72 (m, 3H), 7.64 (d,  $J = 15.5$  Hz, 1H), 7.40 – 7.34 (m, 4H), 7.17 – 7.05 (m, 8H), 6.94 – 6.89 (m, 2H), 3.86 (s, 3H).  $^{13}C$  NMR (101 MHz, DMSO)  $\delta$  187.17, 163.01, 149.37, 146.31, 142.87, 130.73, 130.66, 130.19, 129.74, 127.84, 125.16, 124.24, 120.85, 119.44, 113.94, 55.51; HRMS (ESI MS) m/z: theor: 406.1802 found: 406.1809 ( $[M+H]^+$  detected).

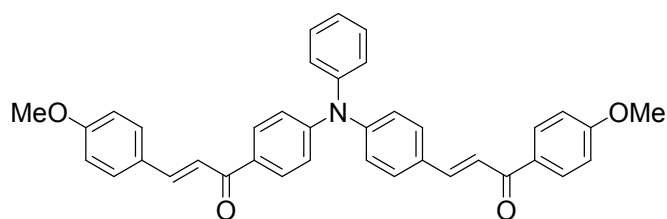
Synthesis of (*2E,2'E*)-3,3'-((phenylazanediyl)bis(4,1-phenylene))bis(1-(3-methoxy phenyl)prop-2-en-1-one) (**chalcone 8**)



4,4'-(Phenylazanediyl)dibenzaldehyde (3.01 g, 10 mmol,  $M = 301.34$  g/mol) and 3'-methoxyacetophenone (3.00 g, 20 mmol,  $M = 150.18$  g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature

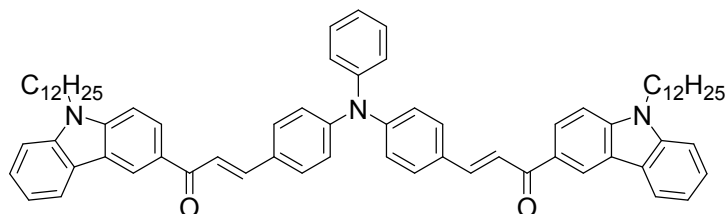
overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of SiO<sub>2</sub> using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (2.54 g, 45% yield). <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.78 (d, *J* = 15.6 Hz, 2H), 7.61 – 7.53 (m, 6H), 7.44 – 7.38 (m, 4H), 7.38 – 7.32 (m, 2H), 7.20 – 7.15 (m, 4H), 7.14 – 7.10 (m, 7H), 3.89 (s, *J* = 2.0 Hz, 6H); HRMS (ESI MS) *m/z*: theor: 566.2326 found: 566.2328 ([M+H]<sup>+</sup> detected); Anal. Calc. for C<sub>38</sub>H<sub>31</sub>NO<sub>4</sub>: C, 80.7; H, 5.5; O, 11.3; Found: C, 80.8; H, 5.4; O, 11.3 %.

Synthesis of (*E*)-3-(4-methoxyphenyl)-1-(4-((4-((*E*)-3-(4-methoxyphenyl)-3-oxoprop-1-en-1-yl) phenyl)(phenyl)amino)phenyl)prop-2-en-1-one (**chalcone 9**)



4,4'-(Phenylazanediyldibenzaldehyde (3.01 g, 10 mmol, *M* = 301.34 g/mol) and 4'-methoxyacetophenone (3.00 g, 20 mmol, *M* = 150.18 g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of SiO<sub>2</sub> using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (2.88 g, 51% yield). <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.06 – 8.01 (m, 4H), 7.77 (d, *J* = 15.6 Hz, 2H), 7.54 (d, *J* = 8.7 Hz, 4H), 7.45 (d, *J* = 15.6 Hz, 2H), 7.37 – 7.31 (m, 2H), 7.20 – 7.16 (m, 3H), 7.14 – 7.09 (m, 4H), 7.01 – 6.95 (m, 4H), 3.89 (s, 6H). <sup>13</sup>C NMR (101 MHz, CDCl<sub>3</sub>) δ 188.78, 163.47, 149.17, 146.48, 143.53, 131.52, 130.85, 129.89, 129.81, 129.75, 126.20, 125.05, 123.55, 120.30, 113.97, 55.63; HRMS (ESI MS) *m/z*: theor: 566.2326 found: 566.2324 ([M+H]<sup>+</sup> detected).

Synthesis of (2*E*,2'*E*)-3,3'-((phenylazanediyl)bis(4,1-phenylene))bis(1-(9-dodecyl-9*H*-carbazol-3-yl)prop-2-en-1-one) (**chalcone 10**)



4,4'-(Phenylazanediyl)dibenzaldehyde (3.01 g, 10 mmol,  $M = 301.34$  g/mol) and 1-(9-dodecyl-9*H*-carbazol-3-yl)ethan-1-one (7.55 g, 20 mmol,  $M = 377.57$  g/mol) were dissolved in ethanol (50 mL) and aq. KOH (40%) (15 mL) was added. The solution was stirred at room temperature overnight. During reaction, a precipitate formed. It was filtered off, washed several times with ethanol and dried under vacuum. The resulting solid was dissolved in dichloromethane and the solution was filtered on a plug of SiO<sub>2</sub> using dichloromethane as the eluent. The solvent was removed under reduced pressure. Dissolution in a minimum of dichloromethane followed by addition of pentane precipitated a solid that was filtered off, washed several times with pentane and dried under vacuum (4.81 g, 47% yield). <sup>1</sup>H NMR (300 MHz, CDCl<sub>3</sub>)  $\delta$  8.85 (d,  $J = 1.5$  Hz, 2H), 8.23 (dd,  $J = 8.7, 1.7$  Hz, 2H), 8.20 (d,  $J = 7.7$  Hz, 2H), 7.87 (d,  $J = 15.5$  Hz, 2H), 7.69 (d,  $J = 15.5$  Hz, 2H), 7.65 – 7.60 (m, 4H), 7.57 – 7.49 (m, 2H), 7.48 – 7.43 (m, 4H), 7.41 – 7.28 (m, 4H), 7.23 – 7.14 (m, 7H), 4.34 (t,  $J = 7.2$  Hz, 4H), 1.89 (dd,  $J = 14.3, 7.1$  Hz, 4H), 1.47 – 1.22 (m, 36H), 0.87 (t,  $J = 6.7$  Hz, 6H). <sup>13</sup>C NMR (75 MHz, CDCl<sub>3</sub>)  $\delta$  189.59, 149.12, 146.59, 143.32, 143.20, 141.31, 130.01, 129.93, 129.89, 129.84, 126.85, 126.54, 126.19, 124.98, 123.63, 123.39, 122.91, 122.09, 120.90, 120.85, 120.09, 109.40, 108.65, 43.55, 32.05, 29.73, 29.69, 29.62, 29.52, 29.46, 29.11, 27.42, 22.82, 14.26; HRMS (ESI MS)  $m/z$ : theor: 1020.6402 found: 1020.6404 ( $[M+H]^+$  detected).

**Video 1:**



video1.mp4

**Video 2:**



video2.mp4