Supporting Information for

Systemic research of Fluorescent Emulsion Systems and its polymerization process with fluorescent probe by AIE mechanism

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Experimental Section

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Sample	Monomer		Water	AIE lumininogen	Emulsifying agent	Initiator
	Methylmethacrylate	Ethylhexyl acrylate				
AE-TPE-A	40%wt	0	57.4%wt	0.1%wt	2%wt	0.5%wt
AE-TPE-B	40%wt	0	57.3%wt	0.2%wt	2%wt	0.5%wt
AE-TPE-C	40%wt	0	57.1%wt	0.4%wt	2%wt	0.5%wt
AE-TPE-D	40%wt	0	56.9%wt	0.6%wt	2%wt	0.5%wt
AE-TPE-E	40%wt	0	56.7%wt	0.8%wt	2%wt	0.5%wt
AE-TPE-F	40%wt	0	50.9%wt	0.6%wt	8%wt	0.5%wt
AE-TPE-G	40%wt	0	52.9%wt	0.6%wt	6%wt	0.5%wt
AE-TPE-H	40%wt	0	54.9%wt	0.6%wt	4%wt	0.5%wt
AE-TPE-I	40%wt	0	57.9%wt	0.6%wt	1%wt	0.5%wt
AE-TPE-J	20%wt	0	78.95%wt	0.3%wt	0.5%wt	0.25%wt
AE-TPE-K	10%wt	0	89.475%wt	0.15%wt	0.25%wt	0.125%wt
AE-TPE-L	5%wt	0	94.7375%wt	0.075%wt	0.125%wt	0.0625%wt
AE-TPE-M	22.15%wt	17.85%wt	56.9%wt	0.6%wt	2%wt	0.5%wt
AE-TPE-N	26.54%wt	13.46%wt	56.9%wt	0.6%wt	2%wt	0.5%wt
AE-TPE-O	30.36%wt	9.46%wt	56.9%wt	0.6%wt	2%wt	0.5%wt
AE-TPE-P	33.73%wt	6.27%wt	56.9%wt	0.6%wt	2%wt	0.5%wt
AE-TPE-Q	36.71%wt	3.29%wt	56.9%wt	0.6%wt	2%wt	0.5%wt

Study the fluorescence behavior influenced by the content of AIE lumininogen

To study the influence of the relative content of AIE luminogen to the monomer on the fluorescence behavior of fluorescent acrylate emulsion, methylmethacrylate was selected to copolymerize with TPE-containing tetra-acrylate *via* emulsion polymerization at the same concentration(40%wt). With the same content of emulsifying agent(SDS, 2%wt) and initiator(KPS, 0.5%wt), the fluorescent emulsions were prepared by changing the relative content of AIE luminogen, such as 0.1%wt，0.2%wt，0.4%wt，0.6%wt，and 0.8%wt, which corresponded to AE-TPE-A, AE-TPE-B, AE-TPE-C, AE-TPE-D, and AE-TPE-E, respectively. (AE: Acrylate Emulsion)

Study the fluorescence behavior influenced by the size of the emulsion particles

To study the influence of the size of emulsion particles on the fluorescence behavior of emulsion, methylmethacrylate was selected to copolymerize with TPE-containing tetra-acrylate with the relative content of 0.6%wt *via* emulsion polymerization. The concentration of latex particles and the relative content of initiator(KPS) to the monomers were fixed to be 40%wt and 0.5%wt, respectively, while the relative concentrations of emulsifying agent(SDS) varied by 8%wt, 6%wt, 4%wt, 2%wt and 1%wt, which corresponded to AE-TPE-F(30nm), AE-TPE-G(60nm), AE-TPE-H(90nm), AE-TPE-D(120nm), and AE-TPE-I(180nm), respectively.

Study the fluorescence behavior influenced by the concentration of emulsion

To study the influence of the concentration of emulsion on the fluorescence behavior of acrylate emulsion. AE-TPE-D was selected and diluted to different concentrations, such as 20%wt, 10%wt, and 5%wt, which corresponded to AE-TPE-J, AE-TPE-K, and AE-TPE-L, respectively.

Study the fluorescence behavior influenced by the glass transition temperature of the emulsion

To study the influence of the glass transition temperature (T_g) value on the fluorescence behavior of acrylate emulsion. The relative content of emulsifying agent(SDS)&initiator(KPS) to the monomers and the concentration of latex particles were fixed to be 2%wt, 0.5%wt and 40%wt, respectively. In addition, the relative concentration of AIE luminogen was fixed at 0.6%wt. T_g of the prepared acrylate emulsiton varied with 0℃(AE-TPE-M)，20℃(AE-TPE-N)，40℃(AE-TPE-P)，60℃(AE-TPE-Q)，and 80℃(AE-TPE-R), respectively by changing the relative content of methylmethacrylate(MMA) and ethylhexyl acrylate(2-EHA) according to Fox formula.

$$\frac{1}{T_g}=\frac{W_{MMA}}{T_{gMMA}}+\frac{W_{2-EHA}}{T_{g2-EHA}}$$

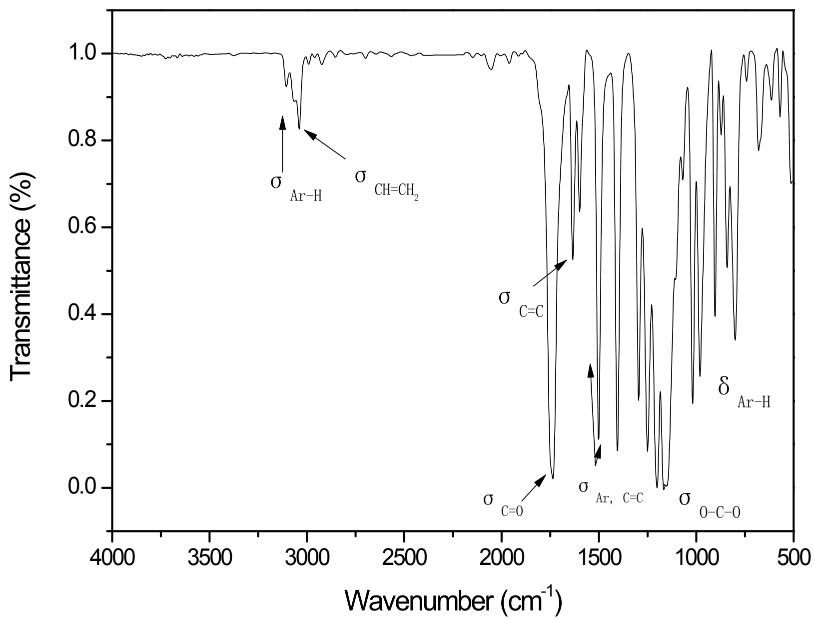
Chemical construction of TPE-containing tetra-acrylate

FTIR (KBr), (cm^{-1}): 3107($\sigma_{C=C\text{-}H}$), 3039 ($\sigma_{Ar\text{-}H}$), 1736 ($\sigma_{C=O}$), 1633 ($\sigma_{C=C}$), 1600,1502,1404(σ_{Ar}), 1160(σ_{OCO}),902,840,800,680($\delta_{Ar\text{-}H}$)

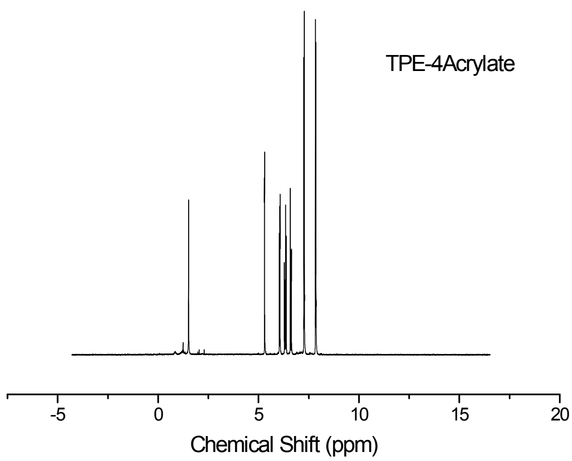
^{1}H NMR (400 MHz, $CDCl_3$), (TMS, ppm): 7.87 (d, 8H, Ar□H), 7.29 (d, 8H, Ar□H), 6.63 (dd, 4H, CH_2 =C□H), 6.35 (dd, 4H, CH=CH□H), 6.07 (dd, 4H, CH=CH□H).

FTIR spectrum of AE-TPE-D

FTIR (KBr), (cm^{-1}): 2997, 2952($\sigma_{C\text{-}H}$), 1730($\sigma_{C=O}$), 1600,1452,1392(σ_{Ar}), 1280-1140($\sigma_{O\text{-}C\text{-}O}$),916,842,810,750($\delta_{Ar\text{-}H}$)



(a)



(b)

Fig.1S. TPE-containing tetra-acrylate (a) FTIR spectrum, (b) ^{1}HNMR spectrum

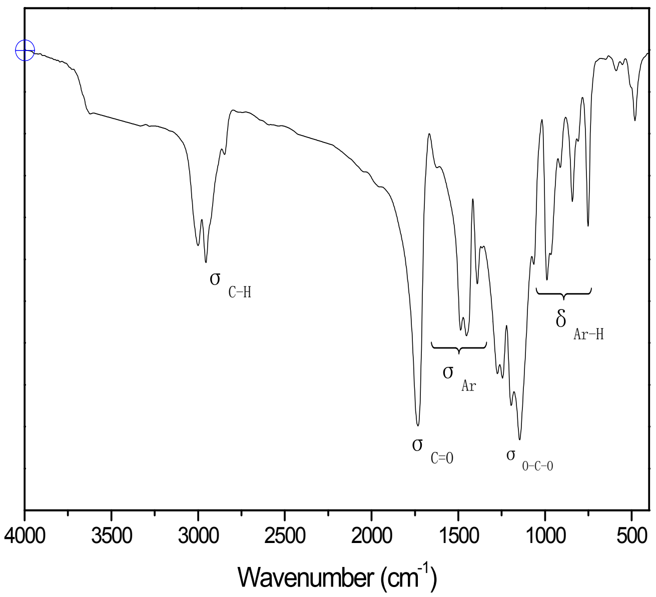


Fig.2S. FTIR spectrum of AE-TPE-D

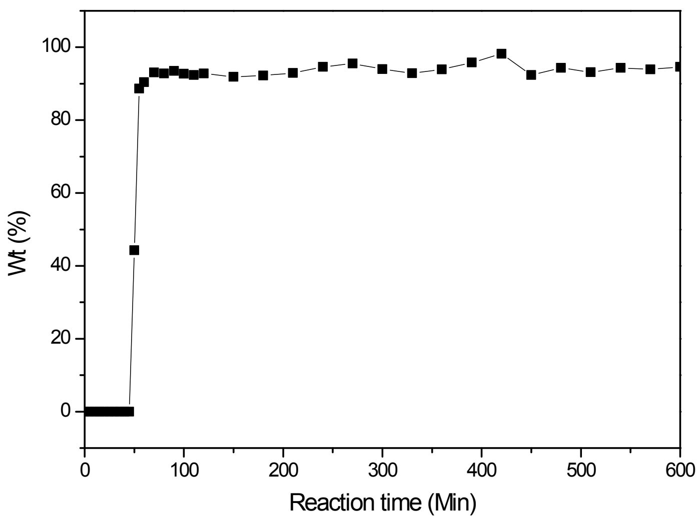


Fig.3S. Solid content of the emulsion varied with the reaction time

Table 2S. molecular weight and molecular weight distribution of AE-TPE-D varied with reaction time

Sample	M_n	M_w	MWD
50min	377000	619600	1.643
55min	371900	578100	1.554
60min	370600	565200	1.525
70min	390800	591000	1.554
80min	394700	557100	1.411
90min	558800	707400	1.266
100min	481100	652200	1.350
110min	603500	800800	1.326
120min	519900	735200	1.414
150min	477200	706200	1.480
180min	483500	718400	1.485
210min	479300	714000	1.490
240min	521200	742000	1.242
270min	513400	731800	1.425
300min	480000	648000	1.350
330min	364100	570300	1.566
360min	361300	614700	1.330
390min	381700	550400	1.442
420min	319300	495200	1.551
450min	330700	588100	1.779
480min	297000	498800	1.679
510min	268600	444700	1.655
540min	287900	491200	1.706
570min	284100	445700	1.569
600min	268900	426000	1.584

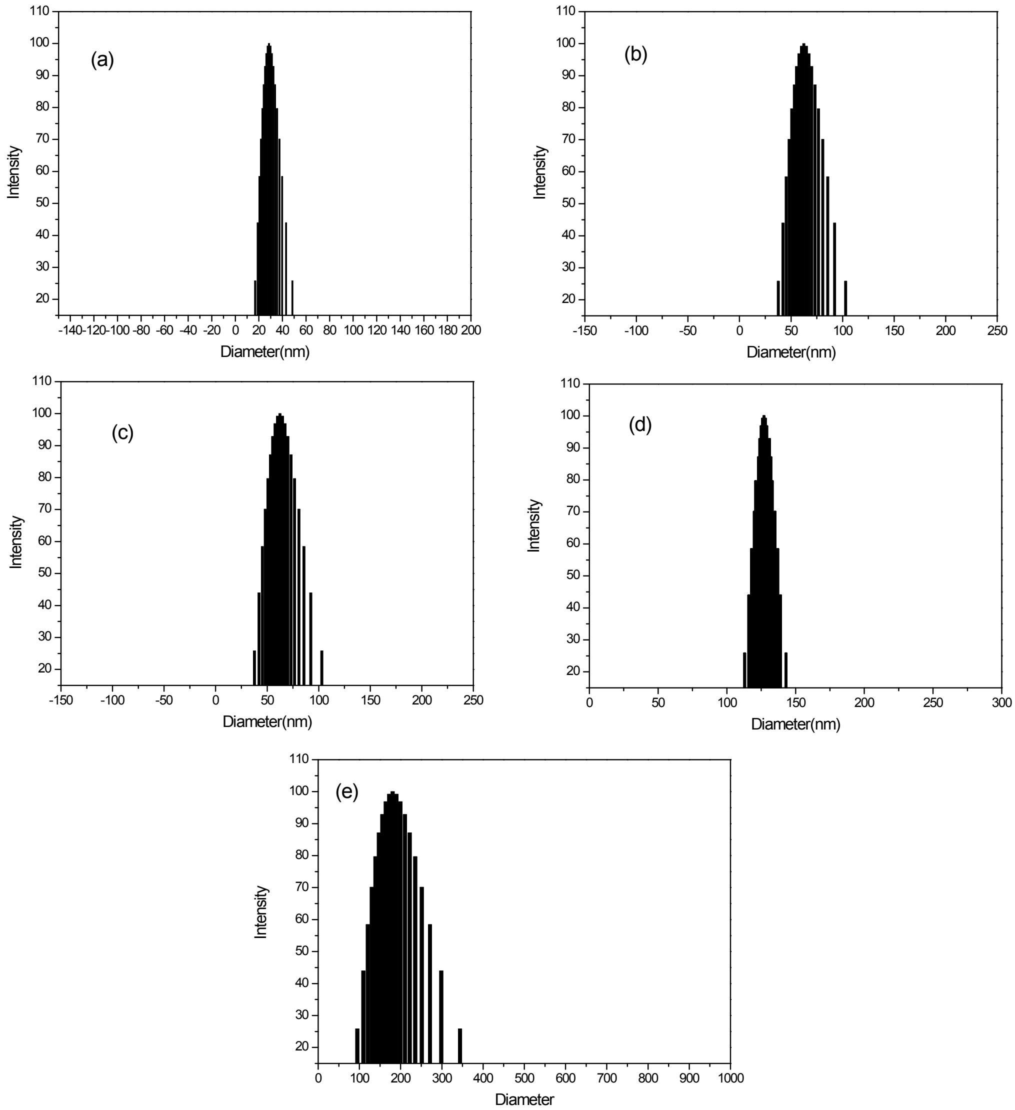


Fig.4S. Particle size and particle size distribution of (a)AE-TPE-F(30nm, 0.01), (b)AE-TPE-G (60nm, 0.05), (c) AE-TPE-H (90nm, 0.08), (d) AE-TPE-I(120nm,0.01), (e) AE-TPE-J(180nm, 0.166)

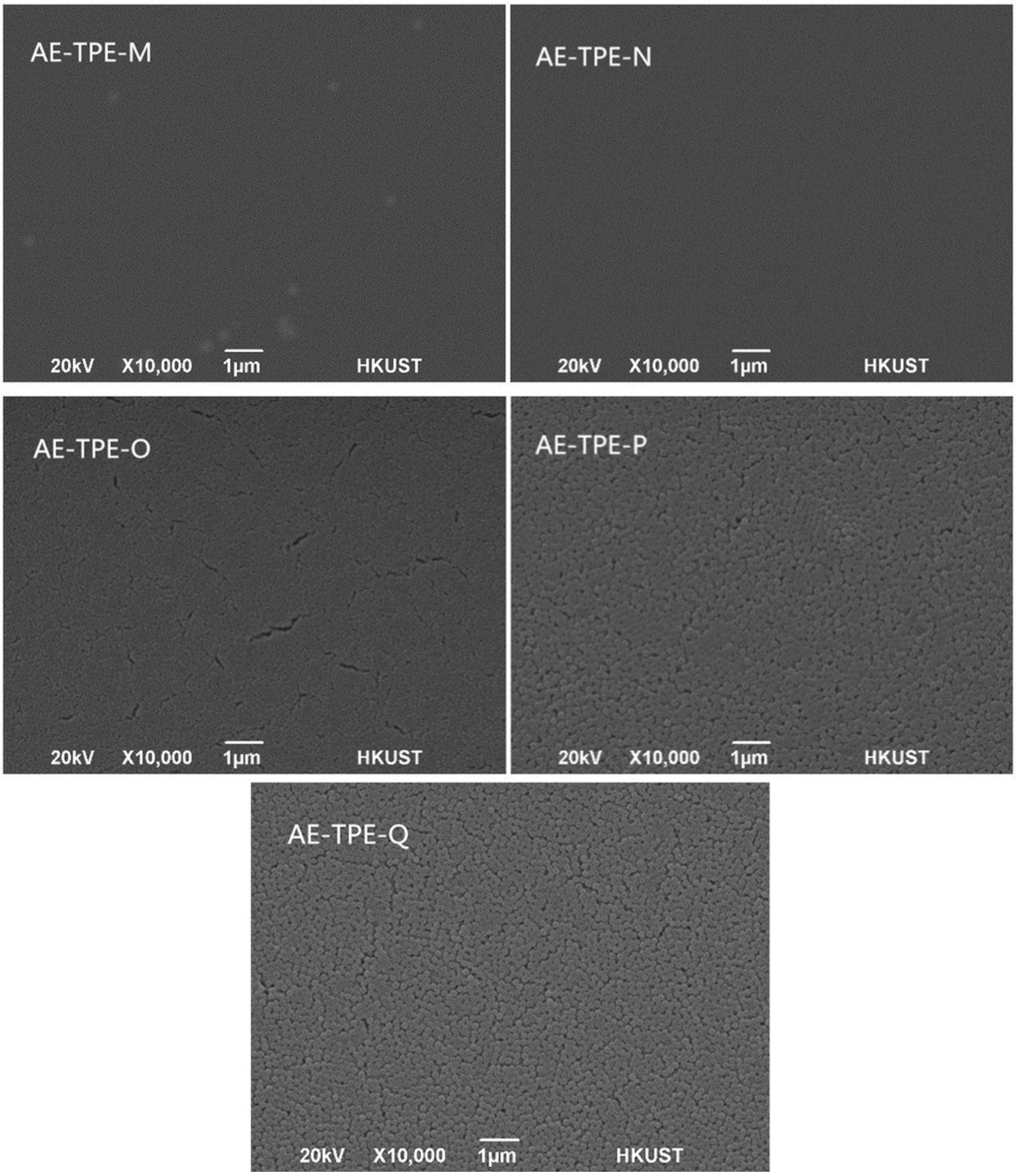


Fig.5S. SEM image of the dried fluorescent acrylate emulsion varied with the glass transition temperature