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SUPPLEMENTARY MATERIAL

A Thermal Thickening System Based on the Self-Assembly of Zwitterionic Hydrophobic Association Polymer and Surfactant

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Synthesis of DNDA

The synthesis route of DNDA was shown in Fig. S1. To start with, oleic acid (43.8 mmol) was added to a three-necked flask, stirring while was added appropriate thionyl chloride (65.7 mmol). The reaction was carried out at 60 ℃ for 4 hours. The unreacted thionyl chloride was removed by distillation under reduced pressure afterwards and to obtain the oleoyl chloride. Diallylamine (42.4 mmol), triethylamine and a small amount of hydroquinone were added into a three-necked flask, the oleoyl chloride (42.4 mmol) was appended under the condition of ice-water bath (0-5 ℃), and waiting for 6h for fully reaction at room temperature. In the end, the DNDA was purified by washing, drying, filtering and rotary drying.

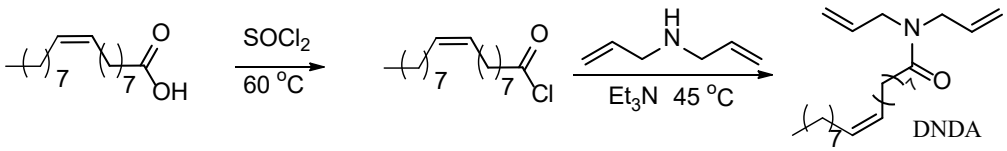

Fig. S1. Synthesis of DNDA.

Optimization of synthesis conditions

The synthesis conditions of zwitterionic hydrophobic association polymer, such as the ratio of AM-AA, the dosage of DNDA and MeSA, the polymerization temperature, and the dosage of the initiator, were optimized by measuring the apparent viscosity of polymer and conversion of AM, to obtain an excellent polymer.The results of the optimization were shown in Fig. S2.

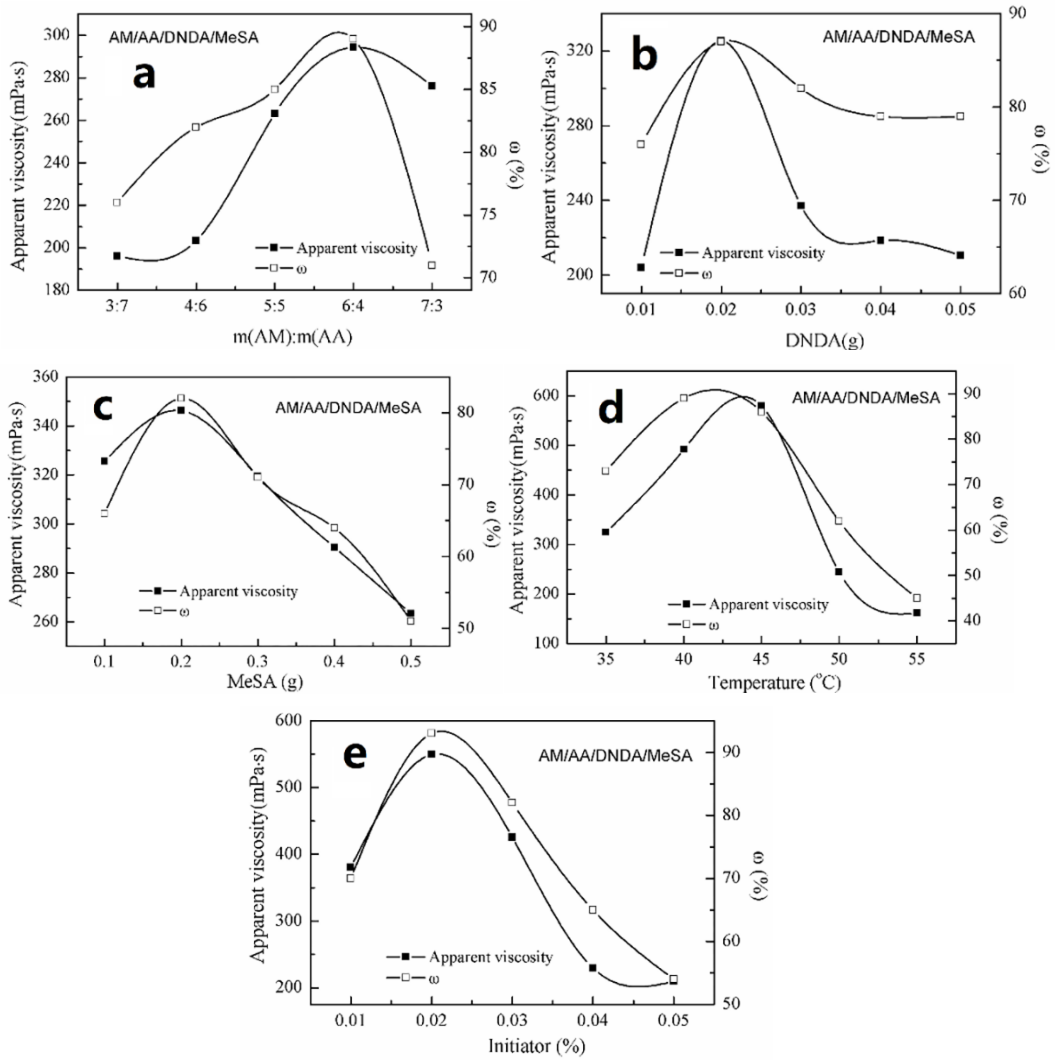

Fig. S2. (a) The curve of ratio of AM to AA; (b) The curve of the amount of DNDA; (c)The curve of the amount of MeSA; (d) The curve of polymerization temperature; (e) The curve of the amount of initiator.

Outflow time

The Table S1 shows the outflow time of the polymer with different concentrations in the Ubbelohde viscometer.

Table S1. The outflow time of AM/AA/DNDA/MeSA.

concentrations (C)	outflow time [a] (s)			
	t_1	t_2	t_3	t
	96.69	96.75	96.72	96.72

1	191.45	191.44	191.25	191.38
0.67	155.66	155.81	155.86	155.77
0.5	140.63	140.75	140.71	140.69
0.33	125.84	125.87	125.97	125.89
0.25	119.06	119.12	119.15	119.11

The outflow time [a] : the temperature is 30℃, and the capillary diameter of Ubbelohde viscometer is 0.55cm.

The mass ratio of polymer to surfactant

Fig. S3 shows the mass ratio of the polymer to surfactant. The apparent viscosity and surface tension were both decreased with the increase of Tween-40. The surface tension shows a sharp decreasing trend and then tends to be stable, while the apparent viscosity decreases slowly and then decreases sharply. The self-assembly system can achieve the best performance when the mass ratio of polymer to surfactant is 1: 2.

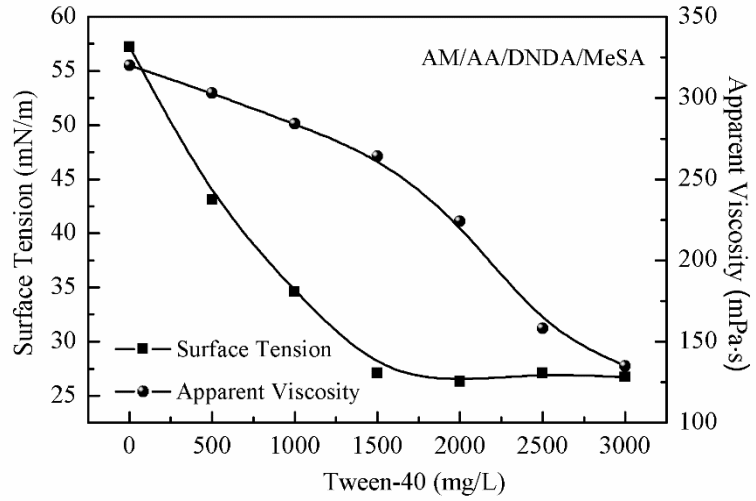

Fig. S3. The mass ratio of polymer to surfactant.