Electronic Supplementary Material (ESI) for Polymer Chemistry.

Supporting Information

Miniemulsion Polymerization of Styrene using Carboxylated Graphene Quantum Dots as Surfactant

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Table S1. Miniemulsions of St and water stabilized by cGQDs and HD before and after ultrasonication, polystyrene miniemulsion latexes and 24 hours after the AIBN-initiated polymerization with concentrations of cGQDs at 1, 3, 5, 7, 9, 10 and 15 wt.%.

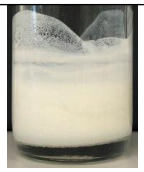
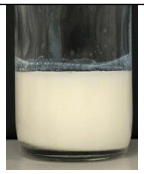
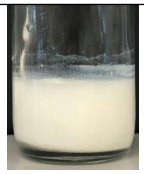
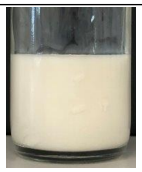
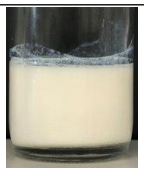
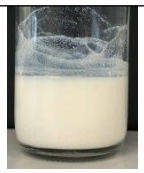
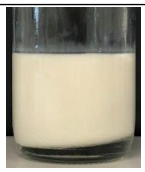
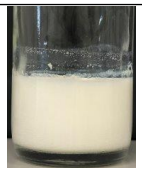
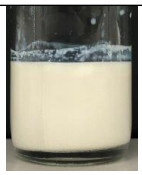
cGQDs wt.%	**Before ultrasonication**	**After ultrasonication**	**After polymerization**	**After 24 hours**
1				
3				
5				
7				
9				
10				
15				

Table S2. Conversion, PDI and zeta potential of cGQDs/polystyrene after 24 h AIBN-initiated miniemulsion polymerization at 70 ^{o}C at different concentrations of cGQDs.

cGQDs wt.%	Conversion (%)	PDI	Zeta potential (mV)
1	36.1	0.55 ± 0.18	- 23.1 ± 12.9
3	43.8	0.22 ± 0.09	- 34.1 ± 3.5
5	38.3	0.03 ± 0.01	- 41.0 ± 0.2
7	57.4	0.06 ± 0.01	- 41.6 ± 0.7
9	53.6	0.06 ± 0.03	- 44.2 ± 0.5
10	71.5	0.05 ± 0.03	- 42.8 ± 1.3
15	76.3	0.07 ± 0.02	- 44.7 ± 0.9

Table S3. Z-average, intensity, number and volume average sizes in nanometers (nm) of styrene droplets stabilized by cGQDs from DLS after 10 min miniemulsification.

cGQDs wt.%	Z-Average	Intensity	Number	Volume
1	656.4	76.9	19.3	27.8
3	233.0	228.7	174.8	231.6
5	276.4	99.1	35.1	51.8
7	178.0	70.8	39.1	51.0
9	97.6	446.8	33.4	74.8
10	207.0	213.4	168.4	214.7
15	183.1	157.4	131.1	152.8

Table S4. Z-average, intensity, number and volume average sizes in nanometers (nm) of polystyrene particles stabilized by cGQDs from DLS after 24 h of AIBN-initiated miniemulsion polymerization (poor DLS autocorrelation fit at 1 wt.% cGQDs).

cGQDs wt.%	Z-Average	Intensity	Number	Volume
1	3.9×10^4	-	-	-
3	537.8	97.7	94.9	96.8
5	186.2	196.0	163.6	195.4
7	180.7	192.3	158.8	191.2
9	151.9	162.7	125.3	155.8
10	179.4	191.6	152.0	189.3
15	171.3	184.7	142.8	180.8

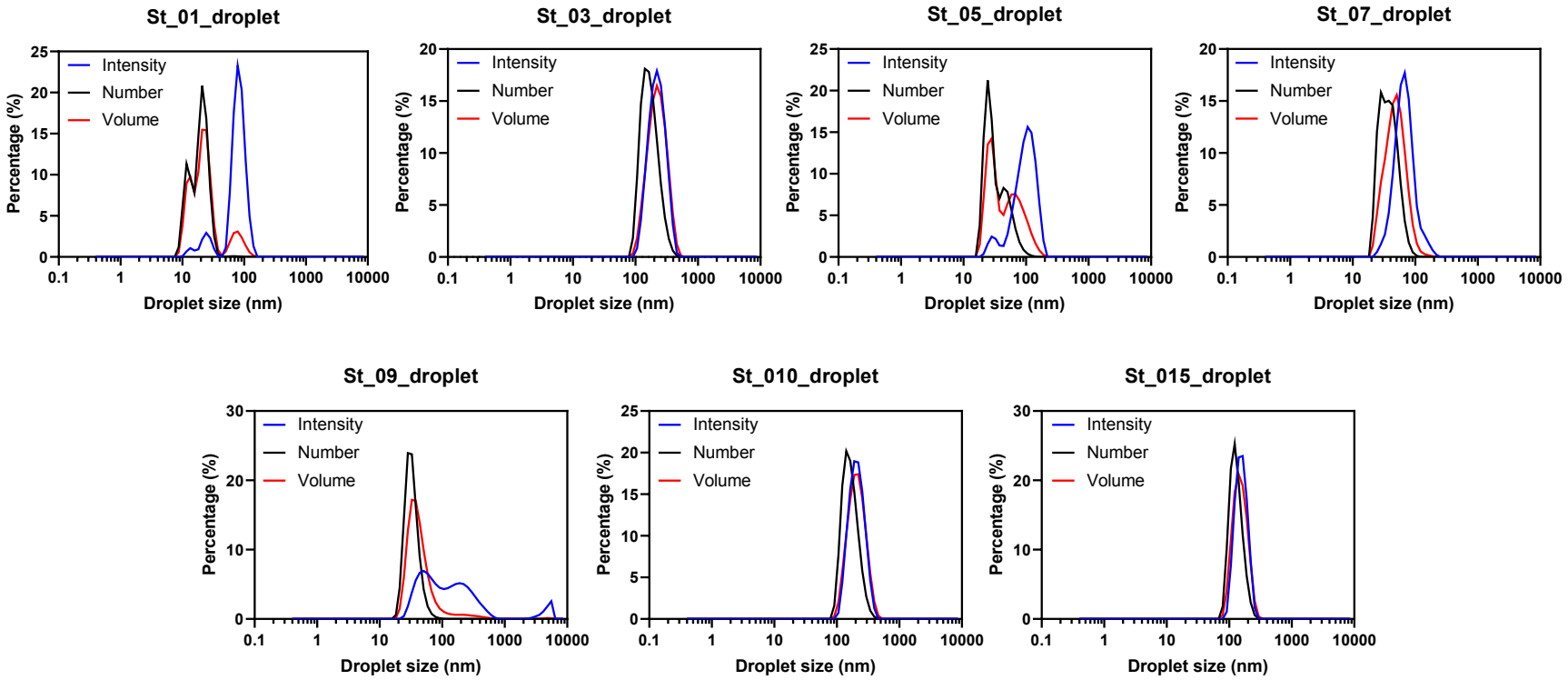


Figure S1. DLS-generated droplet size distribution of miniemulsions of styrene after 10-min ultrasonication, with variation in cGQDs concentration from 1 wt.% to 15 wt.% relative to styrene.

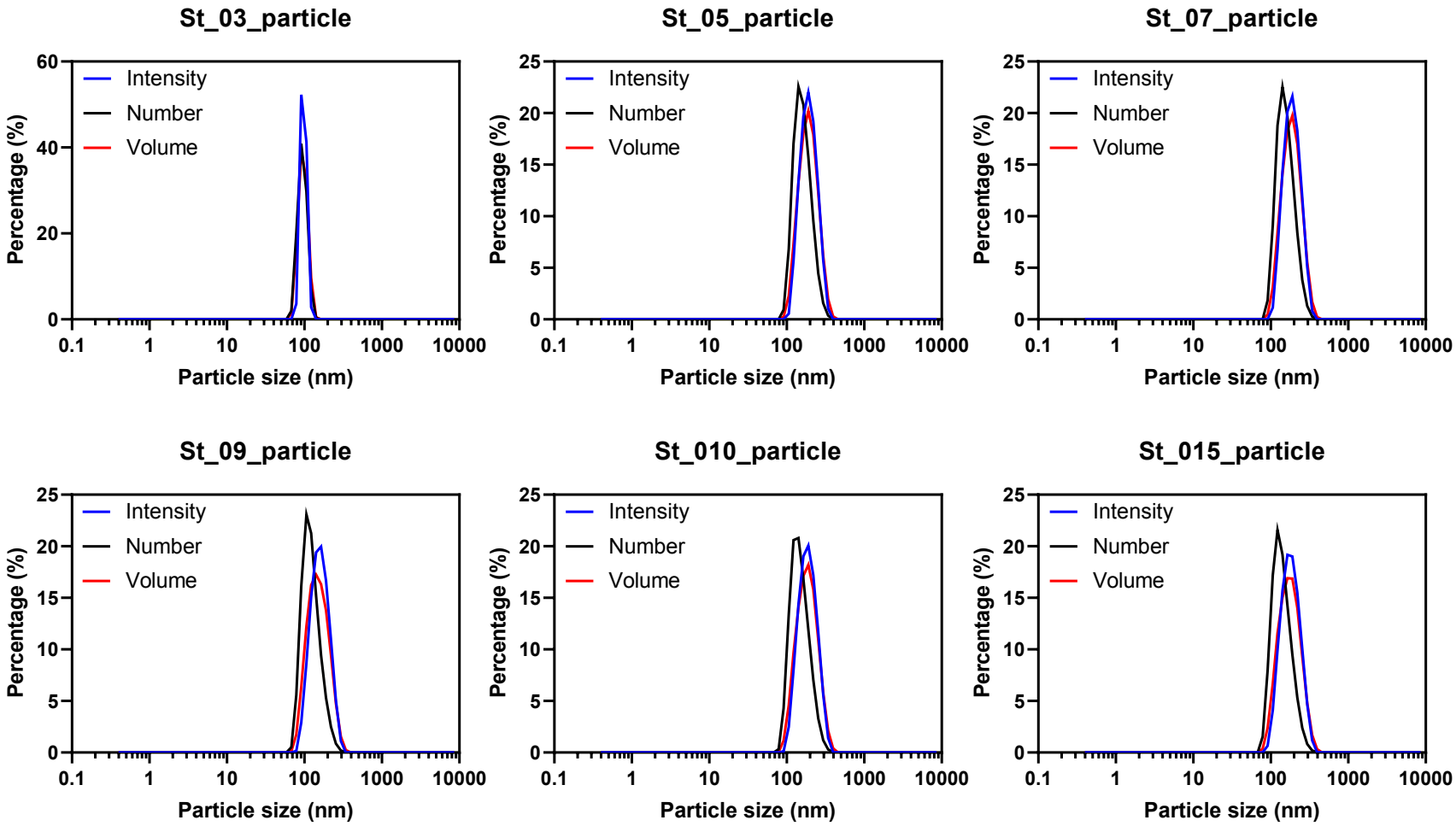


Figure S2. DLS-generated particle size distribution of cGQDs/polystyrene after 24 h AIBN-initiated polymerization, with variation in cGQDs concentration from 3 wt.% to 15 wt.% relative to styrene. Particle size distribution of 1 wt.% cGQDs/polystyrene was unavailable due to being out of DLS range