Electronic Supplementary Material (ESI) for Soft Matter
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Lyotropic phase behavior of polymer-coated iron oxide nanoparticles

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TEM Characterization

Figure S1 shows TEM images of two of the ironoxide nanoparticles used in the present study. These nanoparticles were used for the nanocomposites LA 96 (A, 6 nm) and LA 116 (B, 16.6 nm).

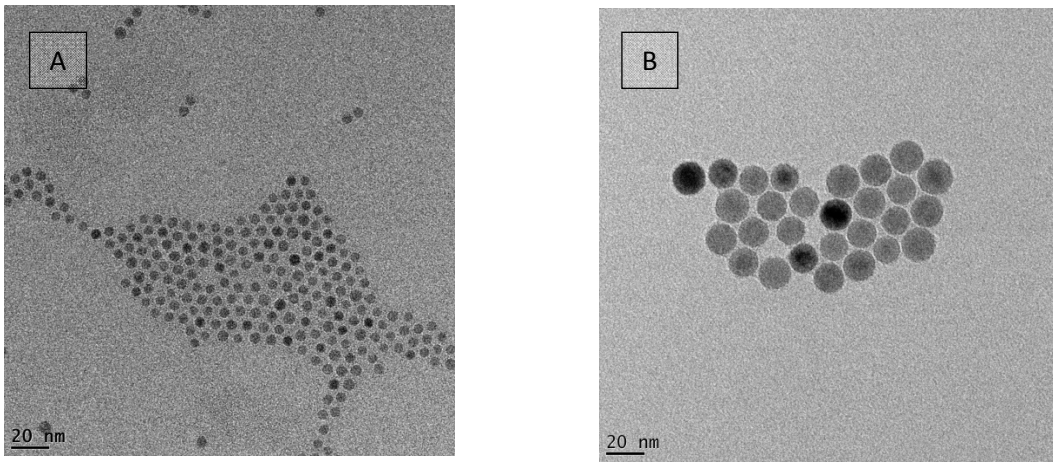

Fig S1. Representative TEM Image of 6 and 17 nm ironoxide nanoparticles coated with oleic acid.

TGA Characterization

In Figure S2 TGA measurements of representative nanoparticle/polymer systems with different nanoparticle sizes and polymer molecular weights are shown. The smallest mass fraction of polymer is observed for the sample LA 96 consisting of very small nanoparticles and relatively long polymer chains (6nm@8k PS). This sample forms bcc lyotropic phases. Large nanoparticles coated with the same polymer have larger weight fractions of nanoparticles (LA 100; 16.6 nm@8k PS) and form fcc lyotropic phases. LA 116 (16.6 nm@28k PS) is in between these two extreme cases. For this system we observe both, fcc and bcc structures.

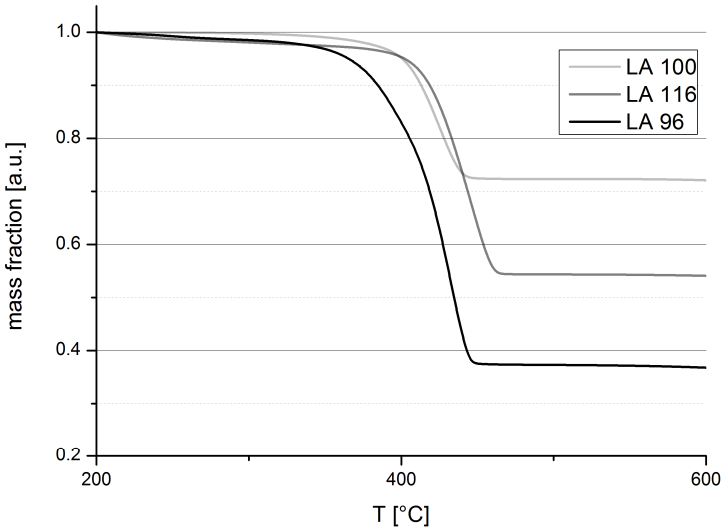

Fig S2. Representative TGA measurements of LA 100 (8nm@8kPS), LA 116 (17nm@28kPS) and LA 96 (6nm@8kPS)

Table S1 Calculated grafting densities of representative nanoparticle/polymer systems

Sample	Grafting density [polymerchain/nm^2]
LA 100 (8nm@8kPS)	0.42
LA 116 (17nm@28kPS)	0.25
LA 96 (6nm@8kPS)	0.63

One can calculate the grafting density *N/A* (in 1/nm^2) from the weight fraction of polymer f_P (obtained from the TGA measurements), the radius of the nanoparticles R, the density ρ of the nanoparticles, assumed to be equal to the bulk values (5.2 g/cm^3), Avogadro's number N_A, and the molecular weight of the polymer M_P as

$$\frac{N}{A} = \frac{f_p * R * \rho * NA}{3 * M_p}$$

Where the factor $\frac{R}{3}$ arrives from the volume to surface ratio of the nanoparticles. The values of the grafting densities are summarized in Table S1.

Results for calculated SAXS-measurements

The scattering curves in Figure. 1, 2 and the 2D-SAXS patterns in Figure 4 were fitted to Eq. (1) using the software Scatter. The obtained structural parameters such as lattice type, unit cell, mean radius of the nanoparticles, nearest neighbour distance *n.n.d*, and sizes of the domains are listed in Table S2 and S3.

Table S2 Structural parameters obtained by fitting Eq. (1) to the measured scattering curves of LA 96

Concentration of LA 96 [% w/w]	lattice	radius [nm]	standard-deviation of the radius	unit cell [nm]	radial domain [nm]	n.n.d. [nm]
10	none	3.2	0.09	-	-	-
20	dis	3.2	0.09	27.8	30	24.0
30	dis	3.2	0.1	27.1	40	23.5
40	dis	3.2	0.09	23.6	32.5	20.5
50	dis	3.2	0.1	21.8	32.6	18.9
60	dis	3.2	0.1	20.7	48.4	17.9
70	bcc	3.2	0.09	18.0	80	15.7
80	bcc	3.2	0.1	16.7	97.4	14.5
90	bcc	3.2	0.1	16.4	117	14.2
bulk	bcc	3.2	0.9	14.9	72.9	12.9

Table S3 Structural parameters obtained by fitting Eq. (1) to the measured scattering curves of LA 116

Concentration of LA 116 [% w/w]	lattice	radius [nm]	standard-deviation of the radius	unit cell [nm]	radial domain [nm]	n.n.d. [nm]
10	none	8.8	0.06	-	-	
20	dis	8.8	0.05	83.1	80	58.8
30	dis	8.9	0.05	82.4	80	58.3
40	fcc	8.8	0.05	55.3	100	39.1
50	fcc	8.8	0.05	53.0	100	37.5
60	fcc	8.8	0.04	51.5	135	36.4
70	fcc	8.8	0.05	47.87	100	33.9
80	fcc	8.8	0.05	51.32	100	36.3
90	fcc	8.7	0.05	42.2	80	29.9
dry	bcc	8.7	0.05	33.2	100	28.8

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