Supplementary information

Processing method determines the long-term stability of particle dispersions in concentrated nanoparticle/polymer suspensions

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1. Sample preparation – residual ethanol

1) In the water-based silica particle solution

Gas chromatography (GC) was used to confirm the amount of residual ethanol in water-based silica particle solution after the solvent exchange process. First, we identified the peak position of pure ethanol and water, respectively. Next, we measured GC data of the water-based silica particle solution after the solvent exchanging process. By calculating the areal fraction of peak attributed to ethanol solvent in the water-based silica particle solution, we confirmed the amount of residual ethanol is less than 0.6%. [1]

2) In the sample of 'M2-melt dilution'

As we described in Section 2.2 in the main text, PEG chains, and silica particles are firstly mixed in ethanol solvent for 'M2-melt dilution'. We evaporated and removed ethanol solvent in a vacuum oven at 70 °C until no further mass loss is found. The FT-IR data of PNCs produced with the same condition of 'M2-melt dilution' removing the initial solvent of ethanol [1] shows that no residual ethanol was left.

2. P(q), form factor model fit



Fig. S1 The experimentally scattered intensity of particle form factor, P(q), (black symbol) are fitted by assuming Log-normal distribution. The fitting results are displayed by red solid line. The average diameter of nanoparticle is found to be around 39.4 nm with 10.9% of standard deviation.

3. I(q) – Hard sphere model fit



Fig. S2 The small-angle X-ray scattering (SAXS) intensities of the concentrated suspension, I(q), with PEG 3.35 kg/mol are fitted by hard sphere model. The fitting results are displayed with yellow solid lines. For clarity, the profiles are vertically shifted. The R_p is 0.5 and ϕ_c is 0.2.



4. Surface coverage rate and polymer desorption rate

Fig. S3 The (a) surface coverage, Γ , and (b) Γ normalized by the initial surface coverage at 3 days of aging time, Γ_{3days} , is plotted as a function of aging time. The black square and blue circle symbols represent the result of 'M1-conc.' and 'M2-melt dilution', respectively. The dashed lines indicate the result of fitting by using the stretched exponential decay equation.

References

[1] S. M. Oh, M. Abbasi, T. J. Shin, K. Saalwächter and S. Y. Kim, Phys. Rev. Lett., 2019, 123, 167801.