The Application of Low Frequency Dielectric Spectroscopy to Analyze Electrorheological Behavior of Monodisperse Yolk-Shell SiO_2/TiO_2 Nanospheres

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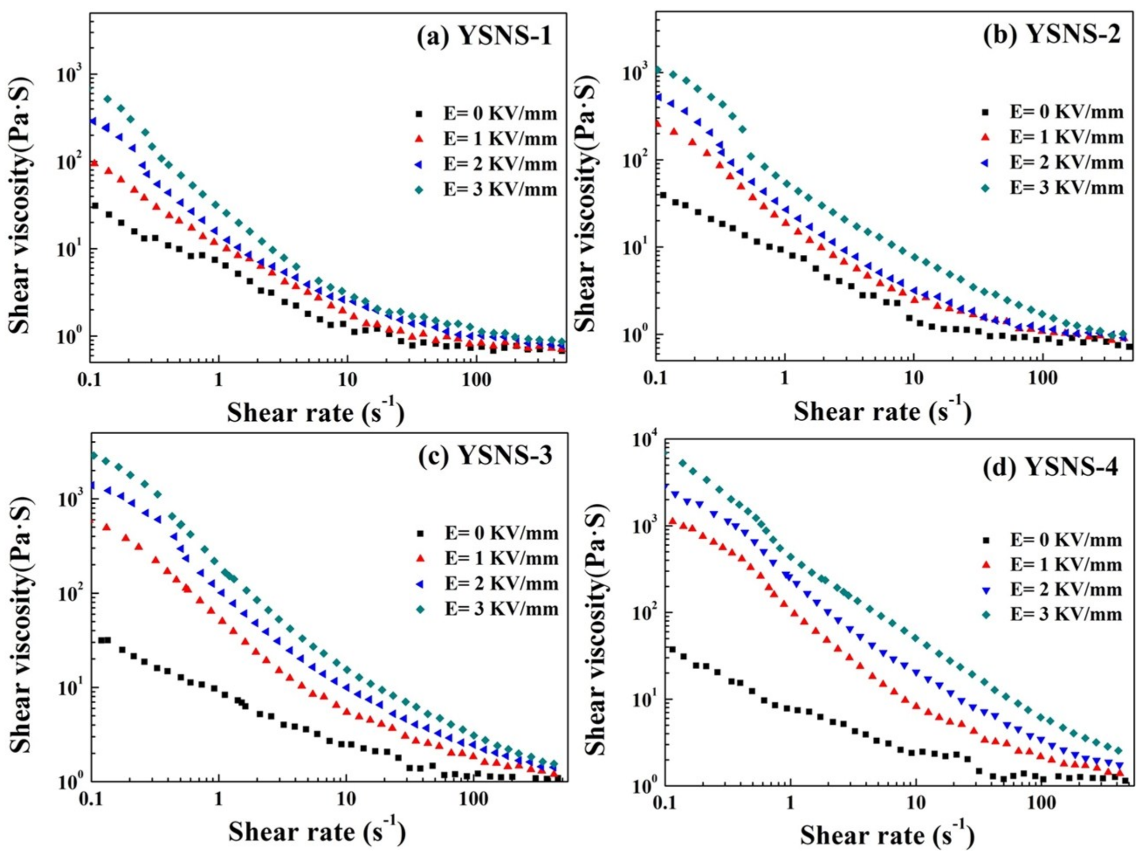

Fig. S1 Shear viscosity versus shear rate for (a) YSNS-1, (b) YSNS-2, (c) YSNS-3, (d) YSNS-4 based ERF under different electric field strength.

Fig. S1 shows the shear viscosity curves of various YSNS-based fluids under different electric field strengths. Under an external electric field, the shear viscosity rapidly decreased with increasing shear rate, demonstrating the typical shear thinning phenomenon of a solid-like property. It was also confirmed that under the same condition, the shear viscosity was raised as the silica core size decreased due to the increased flow resistance between the materials. Meanwhile, the decrease of shear viscosity as a function of shear rate approximately follows the relation:

$$\eta \propto \dot{\gamma}^{\alpha}$$

where α is equal to 1.0 within the wide shear rate region. However, the shear viscosity curves began to fluctuate at low shear rate. This fluctuating region (shear rate < 1.0 s^{-1}) was depicted as formation and deformation of fibril-like structure due to alternative domination of inter-particle force and hydrodynamic force.[1]

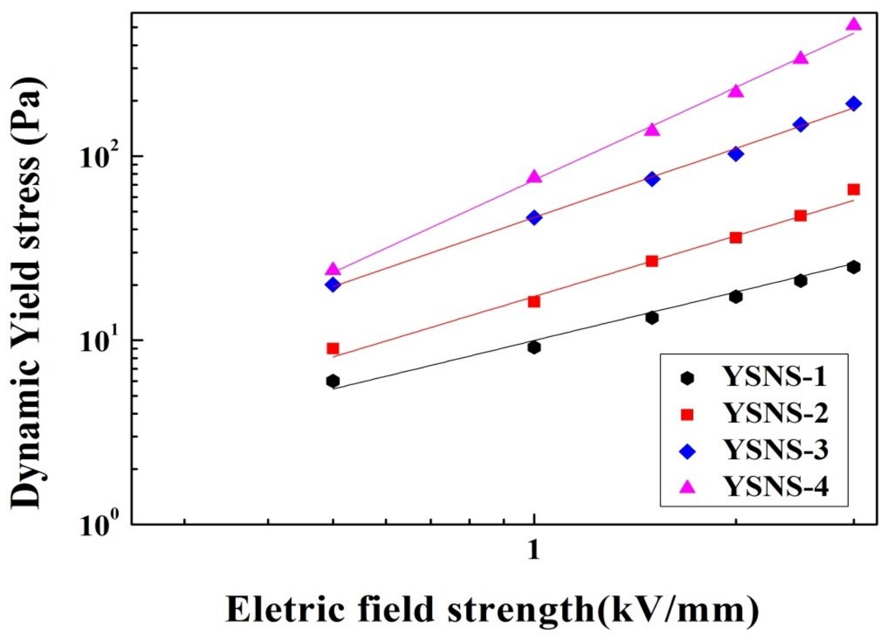

Fig. S2 Dynamic yield stress of the various YSNS based ER fluid as a function of the electric field.

The dynamic yield stress of the various YSNS based ER fluid was obtained by extrapolating the shear stress to a zero shear rate limit, which was also considered to be the shear stress at the starting shear rate.[2]

REFERENCES

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