Supplementary Information

Magneto-induced stress enhancing effect in colloidal suspension of paramagnetic and superparamagnetic particles dispersed in a ferrofluid medium

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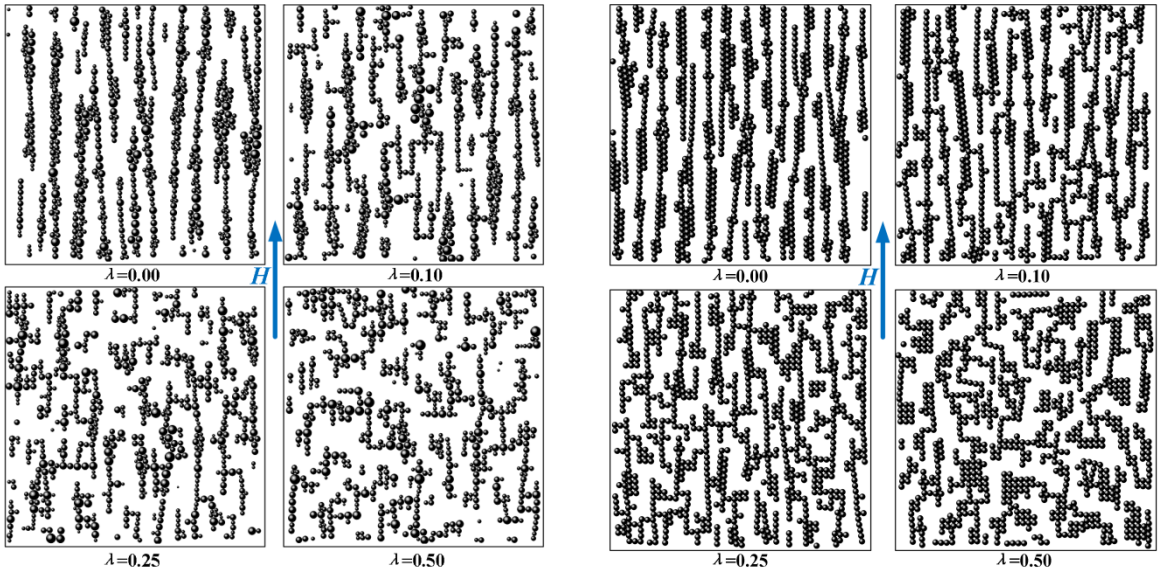
1. Magneto-induced two-dimensional microstructures in colloidal mixture of para/dia-magnetic particles with uniform and log-normal size distribution

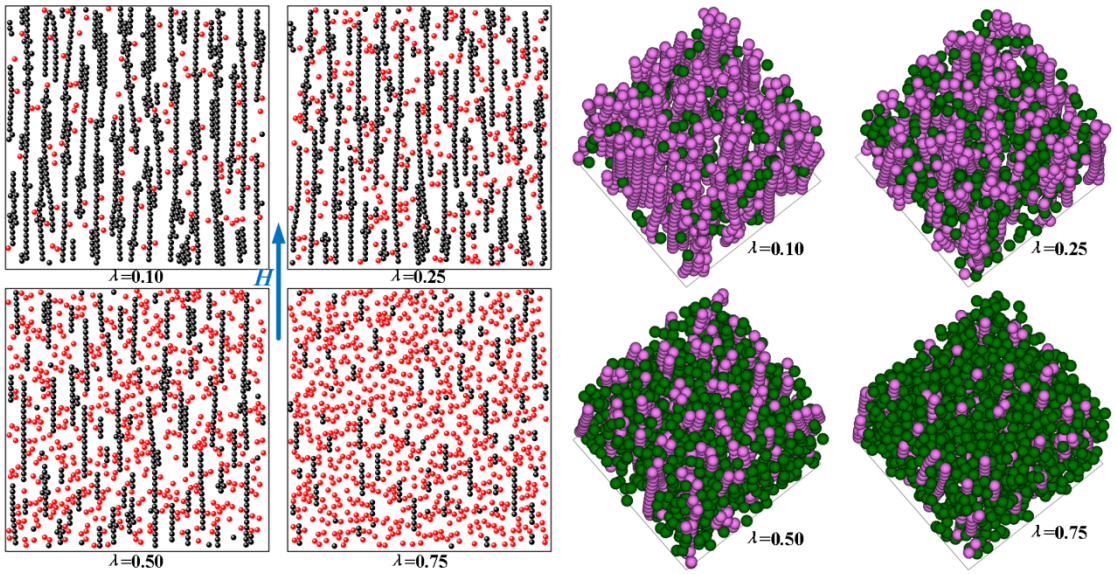


(a) Log-normal size distribution (b) Uniform size distribution

Fig.S1 Magneto-induced microstructures with (φ=20.0 %, λ, γ=1.0) and H=11.2 kA/m.

In both cases of particle size being of uniform and log-normal distribution, the netlike microstructures are more and more apparent with the increasing of the ratio of diamagnetic particles.

2. Magneto-induced microstructures of the colloidal mixture of paramagnetic and nonmagnetic particles



(a) Two-dimensional microstructure (b) Three-dimensional microstructure

Fig.S2 Magneto-induced microstructures with (φ=20.0 %, λ, γ=1.0) and H=11.2 kA/m. The red balls denote the nonmagnetic particles and the black balls denote the paramagnetic particles in (a). The dark green balls denote the diamagnetic particles and the lilac balls denote the paramagnetic particles in (b).

As the nonmagnetic particles are not act with external magnetic field, they randomly disperse in the system among the magneto-induced chains formed by paramagnetic particles. The nonmagnetic particles do not contribute to the static magneto-induced stress, but they will affect the dynamic magneto-induced stress as they can affect the break and restructure of the paramagnetic chains under dynamic loading.

3. Magneto-induced stress state of different particle volume fractions with certain ratios of diamagnetic particles

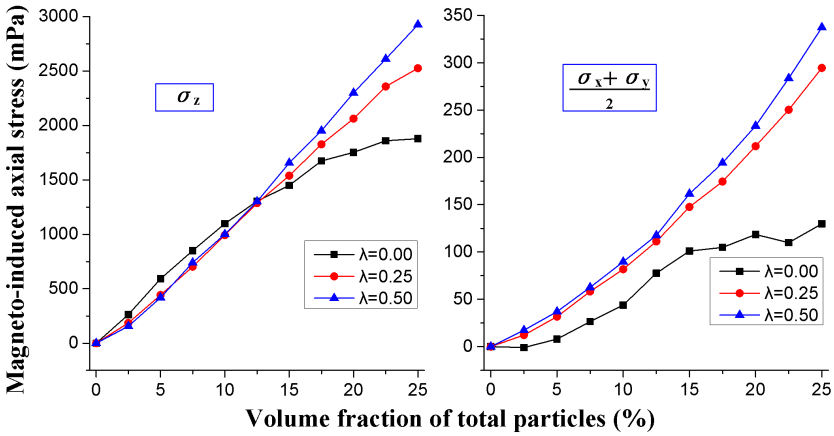


Fig.S3 Magneto-induced stress state of different particle volume fractions.

As the left subfigure shows, the magneto-induced axial stress σ_z along the direction of external magnetic field will be enhanced with the increasing of the ratio of diamagnetic particles when the volume fraction of total particles is larger than 12.5 %, while there is a little reduction to the stress σ_z when the volume fraction of total particles is smaller than 12.5 %. To the transverse stress strength $(\sigma_x+\sigma_y)/2$, there always is an enhancement with the increasing of the ratio of diamagnetic particles for a discretionary volume fraction.