Supplementary Information for

Nontrivial electrophoresis of silica nano and microrods in a nematic liquid crystal

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Frequency dependence of electrophoretic velocities of nano and micro-rods

We have measured the frequency dependent propulsion velocity of the rods. Figure 9 shows the frequency dependence of the velocity of both the nano- and micro-rods in the frequency range of 10-120 Hz. It increases rapidly with frequency to a peak velocity and then de-creases. Overall the frequency response of the silica rods shows a behavior similar to that of the spherical particles. According to the induced charge electrophoresis, the frequency dependence of velocity of a spherical particle is given by

$$V(\omega)=V^{0}\frac{\omega^{2}\tau_{e}^{2}}{(1+\omega^{2}\tau_{p}^{2})(1+\omega^{2}\tau_{e}^{2})} \quad \ldots\ldots\ldots (1)$$

Where $\omega = 2\pi f$, $\tau_p = \lambda_D L/2D$ is the particle charging time and $\tau_e = \lambda_D d/2D$ is the electrode charging time. The experimental data is fitted with Eq. (1), and the continuous red lines show the best fits to the data. The fit parameters are τ_p =0.051 s and τ_e =0.021 s for the nanorods and τ_p =0.049 s and τ_e =0.017 s for the micro-rods.

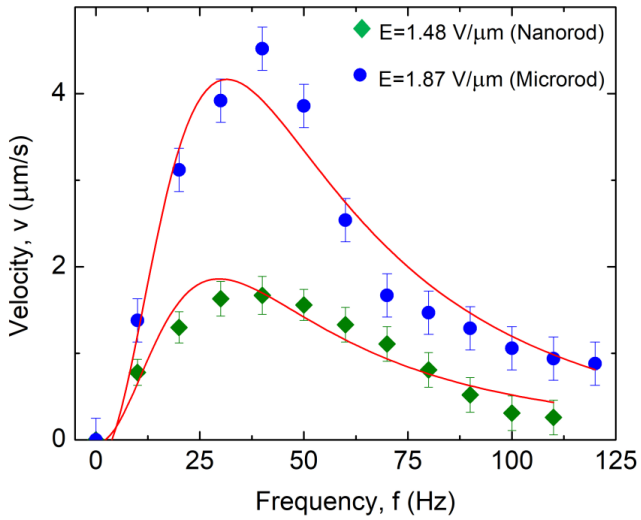

FIG.1: Frequency dependence of velocity of nanorods (solid circles) and microrods (solid diamonds). Solid curves are best fits to Eq. (1).

Description of movies

Movie-S1 (Movie S1.avi): A microrod oriented perpendicular to the director (in a cell with in-plane stripe electrodes) moving at angle with the rubbing direction under increasing DC electric field (1-12 V/μm). The in-plane electric field is applied perpendicular to the rubbing direction.

Movie-S2 (Movie S2.avi): Effect of AC electric field (50Hz, 1.6 V/μm) on a silica microrod in MLC-6608. Video recorded with additional λ-plate in POM.

Movie-S3 (Movie S3.avi): Effect of AC electric field (50Hz, 1.8 V/μm) on a silica nanorod in MLC-6608. Video recorded with additional λ-plate in POM.