Electronic supplementary information (ESI) for PCCP.

Supporting Information

Pattern formation and collective effects in the process of the motion of magnetic nanomotors in narrow channels

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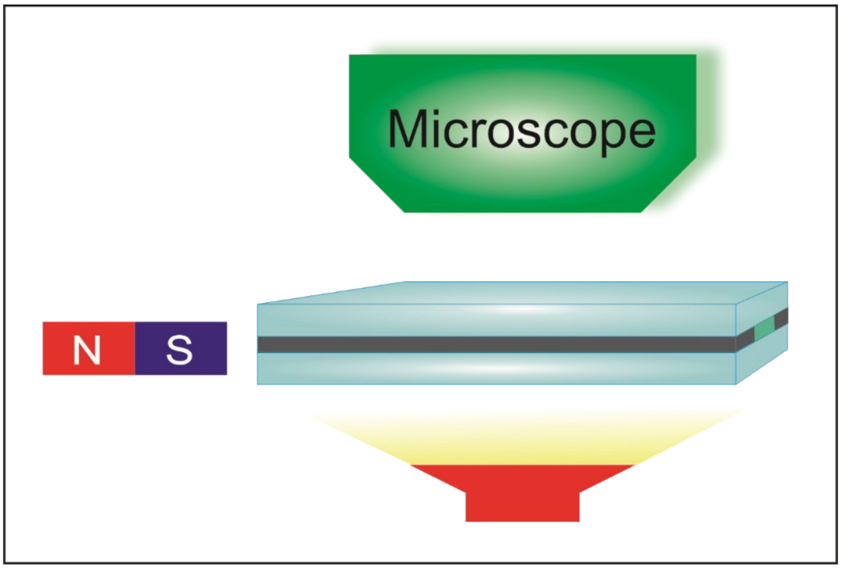

Figure S1. Schematic of the experimental setup.

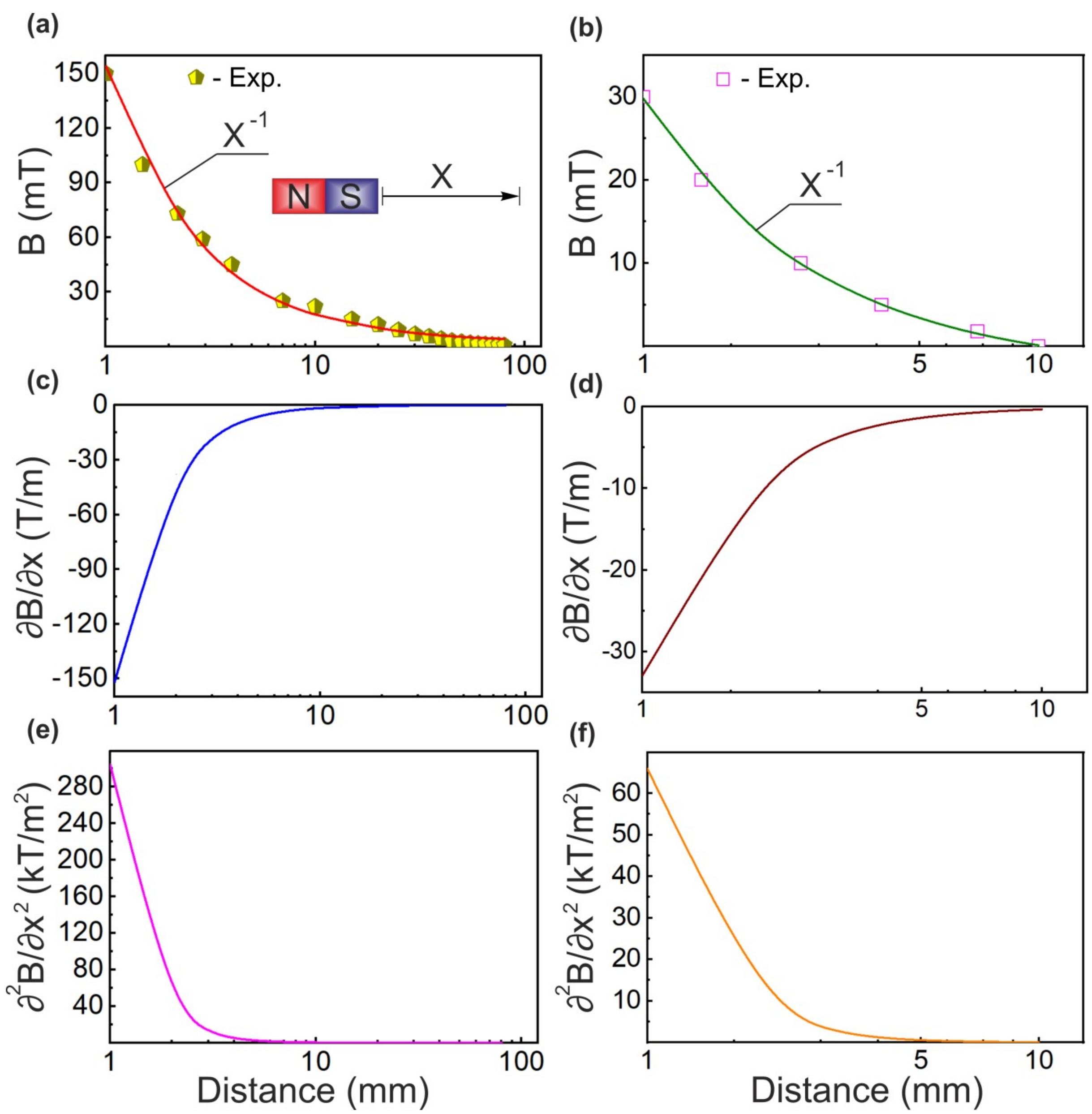

Figure S2. (a), (b) Distribution of the magnetic field strength near the permanent magnet. (c), (d) Distribution of $\partial B/\partial x$ near the permanent magnet. (e), (f) Distribution of $\partial^2 B/\partial^2 x$ near the permanent magnet.

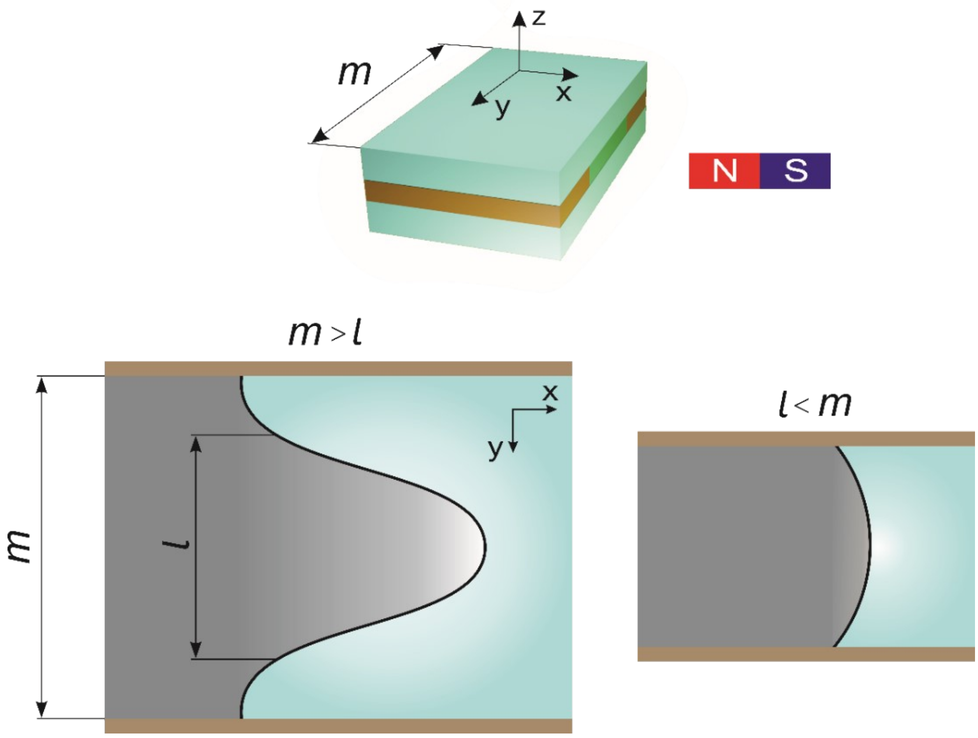

Figure S3. If the channel width occurs to be smaller than characteristic linear scale of perturbations, then there is no development of perturbations on the front.

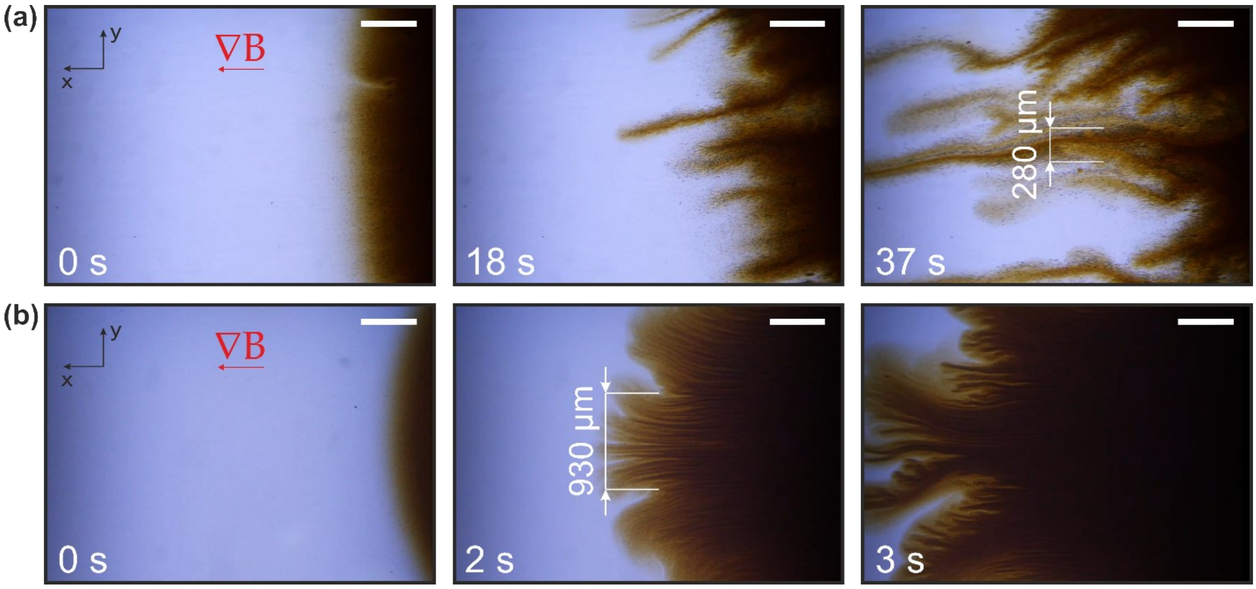

Figure S4. Time-elapsed optical photographs showing the process of front propagation at varied concentration of NPs. Time is counted starting from the initiation of observation. Scale bars: 500 μm. (a) Aqueous suspension Fe_3O_4 7.0 wt.%; (b) 3.5 wt.%.

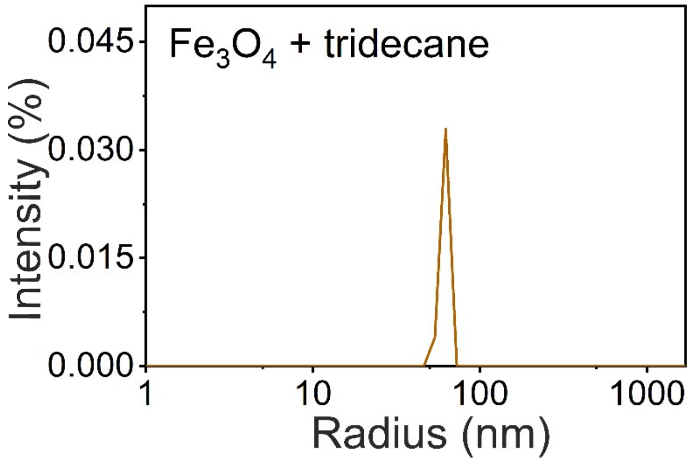

Figure S5. Distribution of hydrodynamic radii of the Fe_3O_4 suspended in tridecane.

Supporting videos

Video S1. Collective motion of magnetic nanomotors in channel. Nanoparticles Fe_3O_4 are suspended in water, channel height is 30 µm, concentration of nanoparticles in the suspension is 7 wt. %. Frequency of filming is reduced by 50 %.

Video S2. Development of perturbations on the propagating front of nanoparticles suspended in tridecane. Channel height is 3 µm, concentration of nanoparticles in the suspension is 7 wt. %. Frequency of filming is reduced by 30 %.

Video S3. Development of perturbations on the propagating front of nanoparticles suspended in water. Channel height is 3 µm concentration of nanoparticles in the suspension is 7 wt. %. Frequency of filming is accelerated by factor of 7.

Video S4. Front instability at $\partial^2 B/\partial x^2 = 20\ kT/m^2$. Channel height is 30 µm, concentration of nanoparticles in the suspension is 7 wt. %. Frequency of filming is reduced by 70 %.

Video S5. Front instability at $\partial^2 B/\partial x^2 = 5\ kT/m^2$. Channel height is 30 µm, concentration of nanoparticles in the suspension is 7 wt. %. Frequency of filming is reduced by 30 %.