Supporting Information for "Morphologies and dynamics of the interfaces between active and passive phases"

Guoqing Xu,[a,b] Tao Huang,[c] Yilong Han,*[d] and Yong Chen *[a,b]

[a]*Center of Soft Matter Physics and Its Applications, Beihang University, Beijing, 100191, China.*

[b]*School of Physics, Beihang University, Beijing, 100191, China.*

[c]*Institute of Physical and Engineering Science, Faculty of Science, Kunming University of Science and Technology, Kunming 650093, Yunnan, China.*

[d]*Department of Physics, The Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, China.*

Movies:

Movie 1: The rough sharp interface from $t = -100$ to 900 at Pe = 300 and $\rho = 0.7$.

Movie 2: Active particles are compressing the passive phase along the x direction during the interface propagation stage from $t = 0$ to 150 at Pe = 300 and $\rho = 0.7$.

Movie 3: Active (red) and passive (blue) particles form a single crystal near the interface without grain boundaries and dislocations during the relaxation stage ($200 < t < 400$) at Pe = 300 and $\rho = 0.7$. The white gap between two rows of several particles forms a slip line rapidly gliding along the lattice direction. A few percent of isolated passive particles are embedded in the active crystal, while active particles are rarely embedded in the passive crystal.

Movie 4: The rough invasive interface from $t = -100$ to 900 at Pe = 300 and $\rho = 0.4$.

Movie 5: The flat interdiffusive interface from $t = -100$ to 900 at Pe = 300 and $\rho = 0.2$.

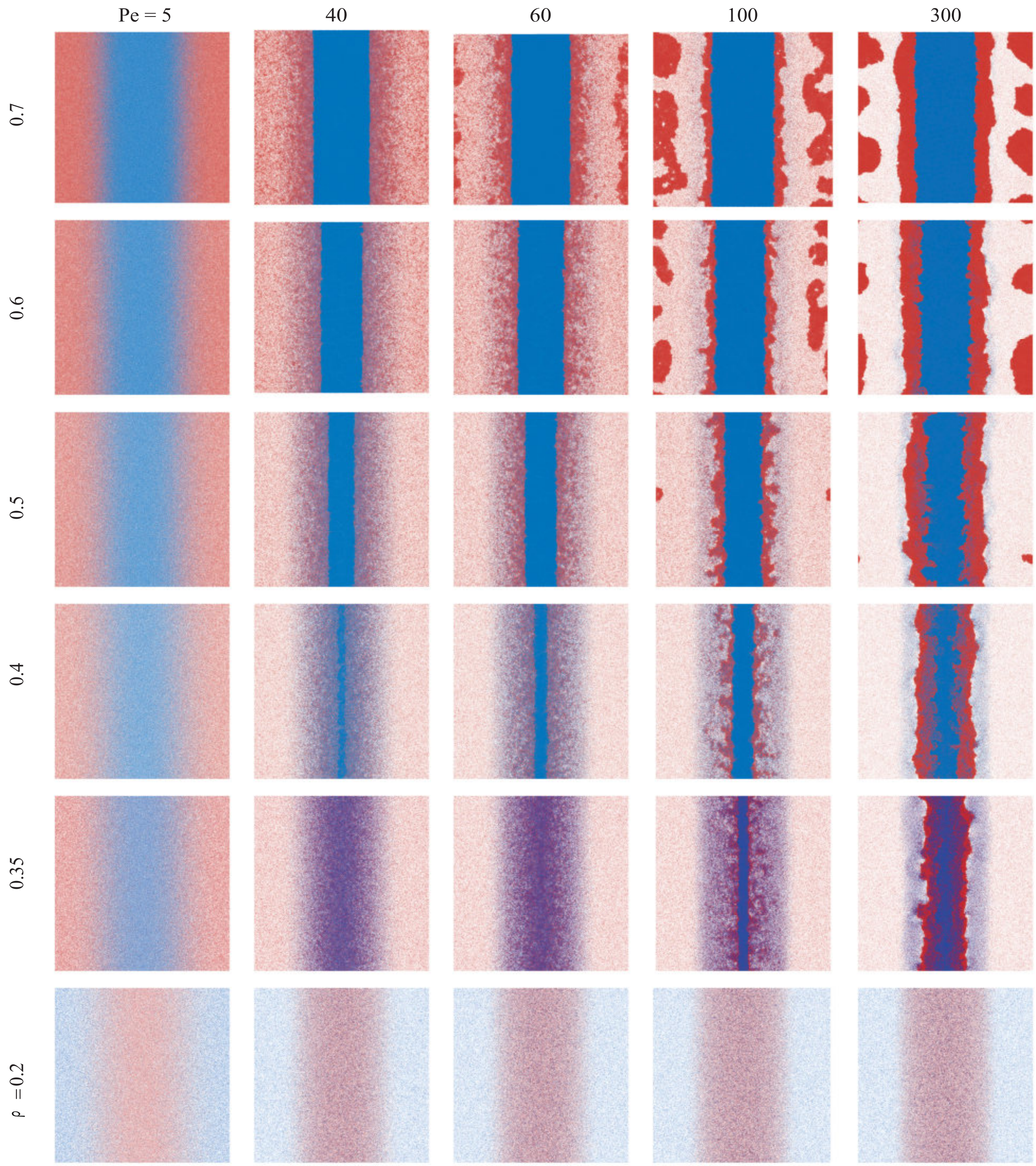

Figure S1: Various active-inactive interfaces in 2D mixtures of active particles (red) and passive particles (blue) with different area fractions ρ and Péclet numbers Pe in the relaxation stage ($t = 900$).

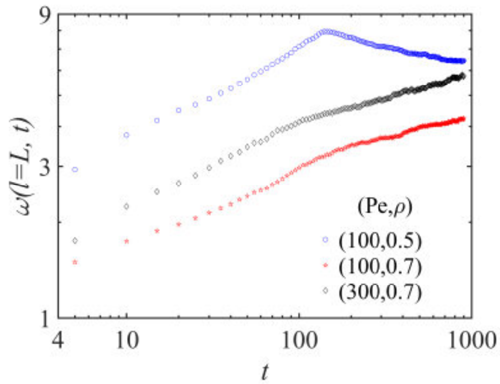

Figure S2: Evolution of roughness $\omega(l = L,t)$ of the interface with the full length L in the y direction at $(\mathrm{Pe},\rho) = (100,0.5)$, $(100,0.7)$, and $(300,0.7)$. $\omega(l = L,t)$ exhibit different power laws in the propagation and the relaxation stages.

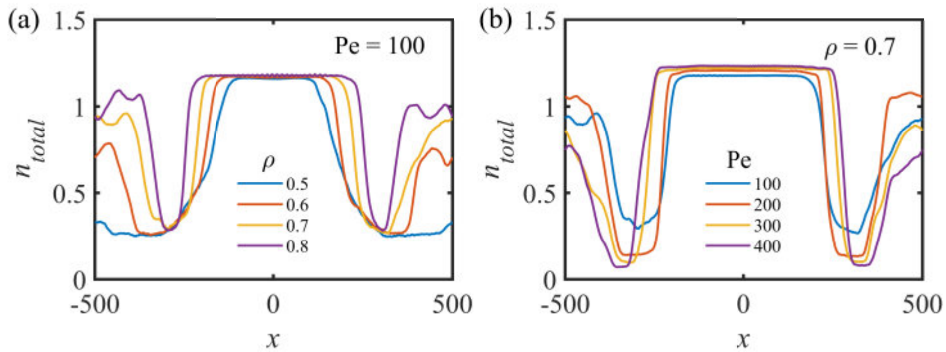

Figure S3: Profiles of the total density of the active and passive particles along the x direction in the relaxation stage ($t = 900$) at different ρ and Pe values. (a) Pe is fixed at 100; (b) ρ is fixed at 0.7.

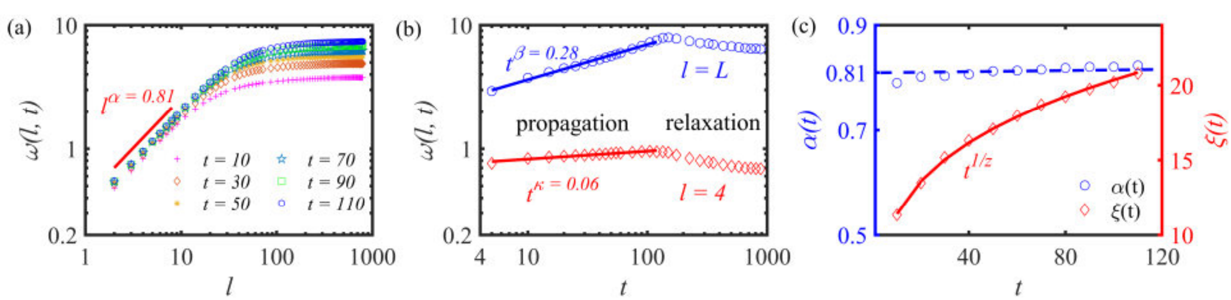

Figure S4: Interface roughness $\omega(l,t)$ at $(\mathrm{Pe},\rho) = (100,0.5)$. $\omega(l,t) \sim l^{\alpha}$ with the fitted $\alpha = 0.81$ at $l \ll \xi(t)$. (b) $\omega(l = L,t) \propto t^{\beta}$ with the fitted $\beta = 0.28$ for the entire interface ($l = L$) and $\omega(l = 4,t) \propto t^{\kappa}$ with the fitted $\kappa = 0.06$ for a short section of the interface with length $l = 4 \ll \xi(t)$ in the propagation stage. In the relaxation stage, $\omega(t)$ decreases with a different exponent. (c) $\alpha(t)$ and $\xi(t)$ obtained by fitting $\omega(l,t)/t^{\beta} = (\frac{l}{\xi(t)})^{\alpha(t)}$ at $l \ll \xi(t)$ in (a). β is obtained from the fitting in (b). $\alpha(t)$ is nearly a constant of approximately 0.81. The fitted $z = 3.97$ obtained by fitting $\xi(t) \sim t^{\frac{1}{z}}$ is close to $z = 3.68$ obtained from the scale relation $z = \alpha/(\beta - \kappa)$.

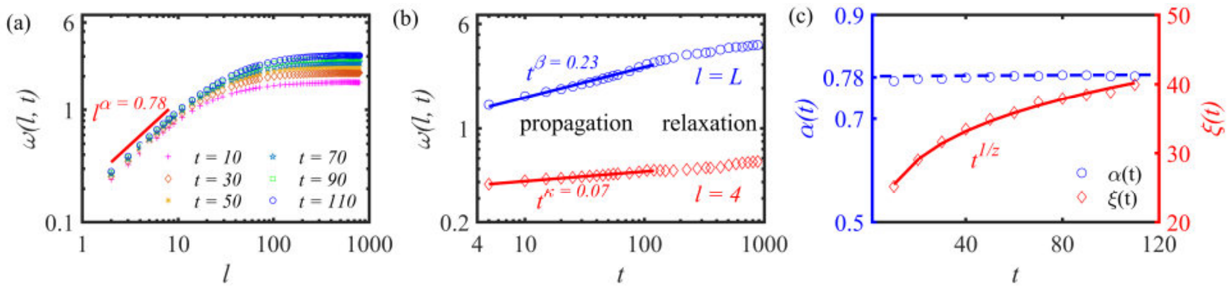

Figure S5: Interface roughness $\omega(l,t)$ at $(\mathrm{Pe},\rho) = (100, 0.7)$. $\omega(l,t) \sim l^{\alpha}$ with the fitted $\alpha = 0.78$ at $l \ll \xi(t)$. (b) $\omega(l = L,t) \propto t^{\beta}$ with the fitted $\beta = 0.23$ for the entire interface ($l = L$) and $\omega(l = 4,t) \propto t^{\kappa}$ with the fitted $\kappa = 0.07$ for a short section of the interface with length $l = 4 \ll \xi(t)$ in the propagation stage. In the relaxation stage, $\omega(t)$ increases with a different exponent. (c) $\alpha(t)$ and $\xi(t)$ obtained by fitting $\omega(l,t)/t^{\beta} = (\frac{l}{\xi(t)})^{\alpha(t)}$ at $l \ll \xi(t)$ in (a). β is obtained from the fitting in (b). $\alpha(t)$ is nearly a constant of approximately 0.78. The fitted $z = 5.27$ obtained by fitting $\xi(t) \sim t^{\frac{1}{z}}$ is close to $z = 4.88$ obtained from the scale relation $z = \alpha/(\beta - \kappa)$.

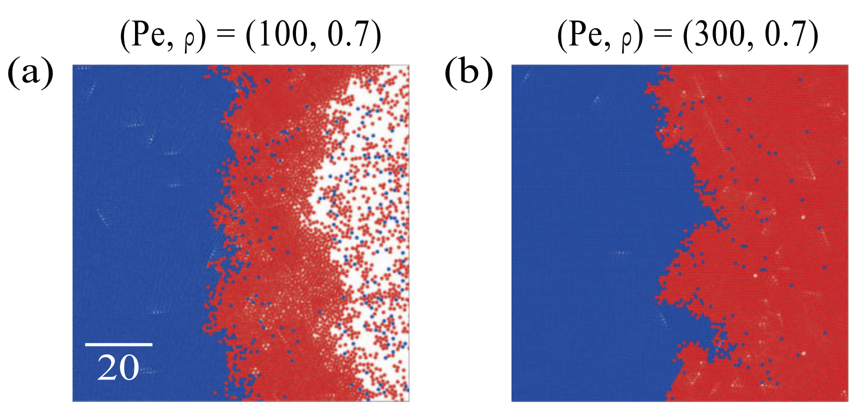

Figure S6: The local morphology of the sharp active-passive interfaces in the relaxation stage ($t = 900$) at $(\mathrm{Pe},\rho) = (100, 0.7)$ in (a) and $(300, 0.7)$ in (b). The local slope of the interface becomes steeper at the higher Pe, i.e., higher activity, in (b).