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Phase transitions in the system of active and passive microswimmers NAVEEN KUMAR AGRAWAL, PALLAB SINHA MAHAPATRA, Indian Institute of Technology Madras, Chennai (600036), India — We study the steady-state phases and their transition in a system of active and passive microswimmers. The active and passive microswimmers are initially, randomly distributed in a fluidic medium inside a square enclosure. The active microswimmers move by a constant magnitude self-propulsion force. Whereas, the passive microswimmers have no self-propulsion force, and they move by force exerted by the fluid and the other neighboring microswimmers. A microswimmer's interactions with other microswimmers and the fluidic medium govern the direction of the exerted thrust on it. We have used a discrete particle model to solve the governing equations. Here, the hydrodynamic interaction is modeled as Stokes drag. The phase transition depends on the coordination coefficients (identified by a parameter χ) of the microswimmers, initial states of the microswimmers, and the fraction of active microswimmers present in the system (ρ). At low χ, the microswimmers exhibit a random motion. For the higher χ values, the phase transits from random motion to the milling phase, where microswimmers rotate around the core. Milling motions with a hollow core are also observed.

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