Collective phenomena in dense suspensions of red blood cells under shear fluctuations via a fluctuating lattice Boltzmann method for non-ideal fluids

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We present simulations of suspensions of red blood cells (RBCs) in simple shear flow. The lattice Boltzmann method (LBM) is used for the suspending fluid, and the finite element method (FEM) is employed to capture the particle deformations. Both components are coupled by the immersed boundary method (IBM). The rheology of the suspensions and the individual and collective dynamics of the RBCs are investigated for different volume fractions (between 35 and 65%), shear rates (over two orders of magnitude), and particle deformabilities. It is shown that the transition from tumbling to tank-treading rotation at intermediate shear rates plays a major role in understanding the suspension properties, including the deformation and orientational ordering states and the shear induced diffusivity of the RBCs.