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Porous walls impact on suspension flows[1] SEYEDMEHDI ABTAHI, University of Illinois at Chicago, MARCO ROSTI, KTH Royal Institute of Technology, PARISA MIRBOD, University of Illinois at Chicago, LUCA BRANDT, KTH Royal Institute of Technology — Suspension flows are encountered in various industrial applications including blood flow, transport of slurries, and pharmaceutical industries. We study suspensions of rigid particles in a plane Couette flow with porous walls. To tackle the problem at hand, we perform three-dimensional Direct Numerical Simulations of a plane Couette flow with a suspension of neutrally buoyant rigid particles simulated with an Immersed Boundary Method, while the flow inside the porous walls is simulated using the volume-averaged Navier-Stokes equations. We show that the porous walls produce a shear-thinning effect in the suspensions and this behavior originates from the interactions between the rigid particles, the porous walls and the carrier fluid: non-zero velocity fluctuations at the interface between the porous layers and the clear fluid regions are triggered by the presence of the particles, which in return migrates towards the bulk of the channel. We found that the effect grows with the particle volume fractions and with the permeability of the porous material. At the end for comparison, we also present how the interaction between porous walls and a particle suspension affects a fully developed plane turbulent channel flow.

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