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Magnetically Driven Flows of Suspensions of Rods to Deliver Clot-Busting Drugs to Dead-End Arteries ROGER BONNECAZE, MICHAEL CLEMENTS, The University of Texas at Austin — Suspensions of iron particles in the presence of a magnetic field create flows that could significantly increase the delivery of drugs to dissolve clots in stroke victims. An explanation of this flow rests on the foundation of the seminal works by Prof. Acrivos and his students on effective magnetic permittivity of suspensions of rods, hydrodynamic diffusion of particles, and the flow of suspensions. Intravenous administration of the clot dissolving tissue plasminogen activator (tPA) is the most used therapy for stroke. This therapy is often unsuccessful because the tPA delivery is diffusion-limited and too slow to be effective. Observations show that added iron particles in a rotating magnetic field form rotating rods along the wall of the occluded vessel, creating a convective flow that can carry tPA much faster than diffusion. We present a proposed mechanism for this magnetically driven flow in the form of coupled particle-scale and vessel-scale flow models. At the particle-scale, particles chain up to form rods that rotate, diffuse and translate in the presence of the flow and magnetic fields. Localized vorticity created by the rotating particles drives a macroscopic convective flow in the vessel. Suspension transport equations describe the flow at the vessel-scale. The flow affects the convection and diffusion of the suspension of particles, linking the two scales. The model equations are solved asymptotically and numerically to understand how to create convective flows in dead-end or blocked vessels.

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