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How to Magnetically Generate Flows in Dead-Ends with Dilute Suspensions of Iron Particles ROGER BONNECAZE, MICHAEL CLEMENTS, University of Texas at Austin — Dilute suspensions of iron particles in the presence of a magnetic field can create flows in dead-ends of pores, channels and even blocked arteries to help dissolve clots. Observations show that added iron particles in a rotating magnetic field form rotating rods along the wall of the blocked channel, creating a convective flow. We present a proposed mechanism for this magnetically driven flow in the form of coupled particle-scale and channel-scale flow models. At the particle-scale, particles chain up to lengths balancing magnetic and hydrodynamic forces on the resulting rods. The weak gradient of the magnetic field causes the rods to accumulate on one side of the channel. The rods rotate due to the rotating magnetic field, provided the field strength is high enough, which creates a localized body couple in the flow that drives a macroscopic convective flow in the channel. Coupled transport equations for the particles and the suspension as a whole are presented. The model equations are solved asymptotically and numerically and compared to experimental observations. Design rules for implementation of this technique are presented to optimize the flow.

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