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The Dynamics of Agglomerated Ferrofluid in Steady and Pulsatile Flows[1] ALICIA WILLIAMS, KELLEY STEWART, PAVLOS VLACHOS, Virginia Tech — Magnetic Drug Targeting (MDT) is a promising technique to deliver medication via functionalized magnetic particles to target sites in the treatment of diseases. In this work, the physics of steady and pulsatile flows laden with superparamagnetic nanoparticles in a square channel under the influence of a magnetic field induced by a 0.6 Tesla permanent magnet is studied. Herein, the dynamics of ferrofluid shedding from an initially accumulated mass in water are examined through shadowgraph imaging using two orthogonal cameras. Fundamental differences in the ferrofluid behavior occur between the steady and pulsatile flow cases, as expected. For steady flows, vortex ring shedding is visualized from the mass, and periodic shedding occurs only for moderate mass sizes where the shear forces in the flow interact with the magnetic forces. At Reynolds numbers below 500 with pulsatile flow, suction and roll up of the ferrofluid is seen during the low and moderate periods of flow, followed by the ejection of ferrofluid during high flow. These shadowgraphs illustrate the beauty and richness of ferrofluid dynamics, an understanding of which is instrumental to furthering MDT as an effective drug delivery device.

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