Abstract Submitted
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**Structure evolution in electrorheological fluids**[1] BIAN QIAN, AHMED HELAL, MARIA TELLERIA, Massachusetts Institute of Technology, MIKE MURPHY, MARC STRAUSS, Boston Dynamics, GARETH MCKINLEY, ANETTE HOSOI, Massachusetts Institute of Technology — Enhanced knowledge of the transient behavior and characteristics of electrorheological (ER) fluids subject to time dependent electric fields carries the potential to advance the design of fast actuated hydraulic devices. In this study, the dynamic response of electrorheological fluid flows in rectilinear microchannels was investigated experimentally. Using high-speed microscopic imaging, the evolution of particle aggregates in ER fluids subjected to temporally stepwise electric fields was visualized. Nonuniform growth of the particle structures in the channel was observed and correlated to field strength and flow rate. Two competing time scales for structure growth were identified. Guided by experimental observations, we develop a phenomenological model to quantitatively describe and predict the evolution of microscale structures and the concomitant induced pressure gradient.

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