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Hysteresis in viscous suspensions HUGO PERRIN, CECILE CLAVAUD, BLOEN METZGER, CNRS - IUSTI, MATTHIEU WYART, EPFL, YOEL FORTERRE, CNRS - IUSTI — Hysteresis is a major feature of the solid-liquid transition in granular materials. This property, by allowing metastable states, can potentially yield catastrophic phenomena such as landslides. The origin of hysteresis in granular flows is still debated. However, most mechanisms put forward so far rely on inertia at the particle level. Here, we study the avalanche dynamics of non-Brownian suspensions in slowly rotating drums and reveal large hysteresis of the avalanche angle even without inertia. By using microsilica particles whose interparticle friction can be turned off, we show that microscopic friction, conversely to inertia, is key to triggering hysteresis. To understand this link between friction and hysteresis, we measured the suspension rheology close to the flow onset for frictional and frictionless suspensions. We show that the flow rule for frictionless particles is monotonous with a power law of exponent 0.37 ± 0.05, in close agreement with the previous theoretical prediction, 0.35. By contrast, the flow rule for frictional particles suggests a velocity-weakening behavior. These findings show that hysteresis can occur in particulate media without inertia, and by highlighting the role of microscopic friction, it questions the intimate nature of this phenomenon.

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