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Dynamic jamming under impact in shear thickening suspensions[1]

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Shear thickening fluids such as cornstarch and water show remarkable impact response allowing, for example, a person to run on the surface. We perform constant velocity impact experiments and imaging in shear thickening fluids at velocities lower than 500 mm/s and suspension heights of a few cm. In this regime where inertial effects are insignificant, we find that fronts with a dynamically jammed (DJ) region behind it are generated under impact. When this front and the DJ region reaches the opposite boundary it is able to support large stresses like a solid. These stresses are sufficient to support the weight of a running person. In addition we find a shear thickening transition under impact due to collision of the fronts with the boundary. There is a critical velocity required to generate these impact activated fronts. Using the observations on fronts, DJ region and using energy balance arguments we construct a model to explain the phenomena of running on the surface of cornstarch suspensions. The model shows quantitative agreement with our measurements using high-speed video of running on cornstarch and water suspensions.

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