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Mechanism of contact network formation leading to discontinuous shear thickening in dense suspensions.[1] PRABHU NOTT, TABISH KHAN, Indian Institute of Science — The phenomenon of discontinuous shear thickening (DST) of dense particle-liquid suspensions has received considerable attention in recent years, and it is now generally believed that the formation of a Coulomb friction-mediated particle contact network causes the dramatic rise in viscosity at a critical shear stress. A common feature of most experimental studies is that the suspension is 'prepared' by pre-shearing for a long time before conducting the shear rate or stress sweep. The implicit assumption in this protocol is that in the prepared state, the stress responds to the applies shear rate/stress within small strain. Here we present experimental evidence that paints a contrasting picture. By following three different shear protocols, we show that substantial strain is required to build up the contact network that culminates in shear thickening. Our study indicates that the contact network results from a cooperative arrangement of smaller clusters of particles. We show that over the period of shear, the suspension goes through continuous shear thickening (CST), then DST, followed by jamming, and finally frictional plastic deformation.

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