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Ants cushion applied stress by active rearrangements ZHONGYANG LIU, JOHN HYATT, NATHAN MLOT, MICHAEL GEROV, ALBERTO FERNANDEZ-NIEVES, DAVID HU, Georgia Institute of Technology — Fire ants, Solenopsis invicta, link their bodies together to form waterproof rafts, which in turn drip, spread, and coagulate, demonstrating properties of an active material that can change state from a liquid to a solid. This soft-matter phase transition is important when the raft interacts with environmental forces such as raindrops and crashing waves. We study this active behavior through plate-on-plate rheology on the ants, extracting the active components by comparison with the rheological behavior of a collection of dead ants. In controlled shear tests, both and live and dead ants show properties of a non-Newtonian fluid, specifically, shear-thinning behavior. In oscillatory tests, live ants exhibit a rare behavior in which their storage modulus (G') and loss modulus (G") have approximately the same value over three orders magnitudes of frequency and two orders of magnitude of strain, indicating the ants are neither fluid nor solid. In comparison, dead ants are more solid-like, with a storage modulus twice as large as their loss modulus. This striking active behavior arises from rearrangement of their bodies and storage and dissipation of energy with the ants' muscles.

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