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Elastic turbulent-like flow of disordered solid composed of polydisperse emulsion drops PETER YUNKER, SHIMA PARSA, STEPHAN KOEHLER, DAVID WEITZ, Harvard University — We experimentally study the low Reynolds number flow of polydisperse emulsion drops through a wide microfluidic channel. Water drops dispersed in oil flow through a microfluidic channel that is 50 microns in height and 1700 microns in width. The drop area fraction is ~ 0.50, and drop size polydispersities range from 5% to 40%. Polydisperse drops are observed to form solid-like plugs in the middle of the channel. These solid plugs of polydisperse drops are squeezed by faster moving oil at the channel edges; in response, the polydisperse drops collectively deform, forming long-lived force chains that resist the faster moving oil. Conversely, monodisperse drops do not form solid-like plugs or long-lived force chains, but instead spread throughout the channel. Surprisingly, the speed fluctuations for flows of polydisperse drops are nonperiodic, and exhibit power-law-like spectral decays similar to those seen in elastic turbulence; for flows of monodisperse drops, the spectra are largely flat. Decreasing interfacial tension causes force chains in flows of polydisperse drops to decrease in size, as drops deform individually rather than collectively.

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