Abstract Submitted
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PIV Measurements of Turbulent Pipe Flow with Drag-Reducing Megasupramolecules[1] DAVID HUYNH, RYAN MCMULLEN, BEVERLEY MCKEON, REDMOND LHOTA, MING-HSIN WEI, JULIA KORNFIELD, Caltech — Toms (1948) was the first to observe that dissolving small amounts of high-molecular weight (HMW) polymers into a liquid can drastically reduce turbulent drag. Ever since, studying polymers in turbulence has been of great fundamental interest, as it can potentially provide insight into the self-sustaining mechanisms of wall turbulence. HMW polymers commonly employed for drag-reduction studies are plagued by chain scission due to the high shear rates accompanying turbulent flow at practical Reynolds numbers (Re); this shear degradation reduces the length of the polymer molecules, diminishing their effectiveness for drag-reduction. However, Wei et al. (2015) have recently developed "megasupramolecules" that perform comparably to traditional HMW polymers and circumvent the shear degradation problem by using end-associating polymers that can break and reassociate reversibly. Particle image velocimetry is used in specialized turbulent pipe flow experiments in the range Re $\approx$ 7.5x10^4-1.2x10^5 to investigate and compare the drag and turbulence characteristics of the (Newtonian) baseline, traditional HMW polymer solutions, and megrasupramolecules.

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