

Abstract Submitted
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Do proteins really unfold in a shear flow?¹ JUAN JASPE, STEPHEN J. HAGEN, Physics Department, University of Florida, Gainesville FL 32611-8440 — Many protein structures unfold (denature) when subjected to extremes of heat, cold, pH, solvent composition, or mechanical stress. One might expect that shearing forces induced by a nonuniform fluid flow would also destabilize proteins, as when a protein solution flows rapidly through a narrow channel. However, although we find many references to shear denaturation in the protein literature, we find no quantitative demonstration of the phenomenon. Therefore we have investigated whether a high shear can destabilize a protein to any measureable extent. We study a small globular protein (horse cytochrome *c*, 104 amino acids) whose fluorescence increases sharply upon unfolding. We pump the sample through a silica capillary (180 μm ID) at speeds ~ 10 m/s to create a simple shear $dv_z/dx \sim 5 \times 10^5 \text{ s}^{-1}$, under UV laser illumination. We can detect unfolding of as little as 1% of the sample, or (under favorable conditions) a reduction of ~ 0.05 kJ/mol in the protein's stability. We will discuss preliminary results along with a simple theoretical perspective on shear denaturation.

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