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Self-assembly of protein fibrils in stable circular Couette flow[1]
SAMANTHA MCBRIDE, CHRISTOPHER TILGER, AMIR HIRSA, Rensselaer Polytechnic Institute, JUAN LOPEZ, Arizona State University — Fluid flows are known to contribute to the chemical dynamics of self-assembling protein fibrils yet the roles of mixing and shear have not been elucidated. These long, crystalline structures are ubiquitous *in-vivo* and strongly associated with many neurodegenerative disorders. Understanding the mechanism of formation is a significant challenge because of the variety of gradients proteins are exposed to in biological fluid channels. A stable circular Couette flow device was constructed in order to conduct comprehensive tests on the effects of pure shear on a protein solution initially free of any pre-existing aggregates. The protein insulin was sheared at various Reynolds numbers at normothermia (37°C). Changes in fluid properties are observed at the onset of fibril precipitation, as the elongated structures generate complex particle-laden fluid dynamics. Measurements include fibrillization lag times, images of protein fibrils induced by shear, and changes to viscosity after exposure to shear. Discussion will cover biological implications and the role of fluid mechanics in pathogenesis of neurodegenerative disorders.

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Amir Hirsa
Rensselaer Polytechnic Institute

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