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Apparent Yield Stress and Interfacial Viscoelasticity of Globular Protein Solutions VIVEK SHARMA, ADITYA JAISHANKAR, Hatsopoulos Microfluids Lab, Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, YING-CHIH WANG, Rheosense Inc, San Ramon, CA 94583, GARETH H. MCKINLEY, Hatsopoulos Microfluids Lab, Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139 — Globular proteins influence the dynamics, phase behavior and transport of biomolecules and drugs in the mammalian body. In conventional rheological studies conducted on torsional rheometers, protein solutions are commonly reported to have a solid-like response at concentrations as low as 0.03% by weight. In this study, we probe the bulk and interfacial viscoelasticity of bovine serum albumin (BSA) solutions as a canonical example of a globular protein system. Using a stress-controlled rotational rheometer, augmented by microfluidic rheometry and interfacial rheometry, we demonstrate that the origin of the yield-like response reported in bulk viscometric flows lies in the formation of a film of adsorbed protein, formed spontaneously at the solution/gas interface. We directly measure the concentration-dependent interfacial viscoelasticity of the adsorbed protein and we describe a coherent means of extracting the interfacial contribution from bulk viscosity measurements. Finally, we demonstrate how the presence of surfactants changes both the interfacial and bulk rheology of pharmaceutical formulations based on protein solutions.

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