TAM 534/498: Non-Newtonian Fluid Mechanics & Rheology

Prof. Randy H. Ewoldt // Spring 2024 // Credits: G(4),U(3)

MW 1:00-2:50pm

COURSE OVERVIEW:

From 3D printing flows to fire-suppressing gels, from Oobleck to Silly Putty, many materials defy basic definitions of fluid and solid. This is the world of **rheology**.

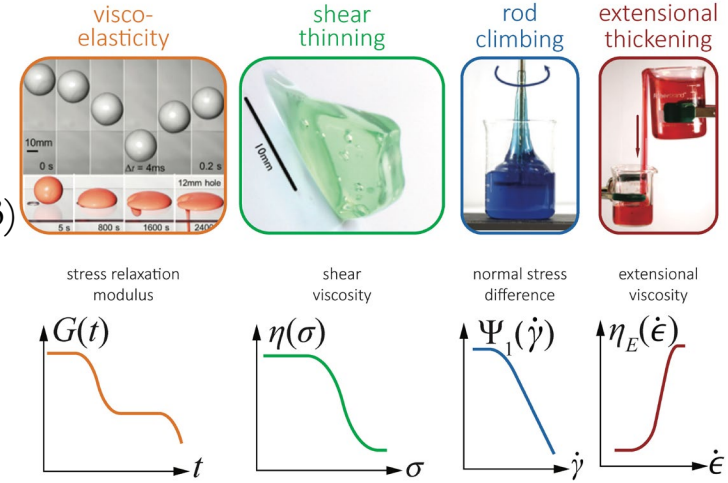
Expand your engineering toolbox to include soft matter and non-Newtonian fluids. Integrate your understanding of mechanics from fluids, to solids, to things-in-between. Develop data analysis and measurement science skills. Rheology is a gateway to practicing interdisciplinary skills that enable today's engineers to make positive impactful contributions to society.

Final is a Course Project (Not a final exam)
3 undergraduate credits
4 graduate credits (advanced homework and project expectations)

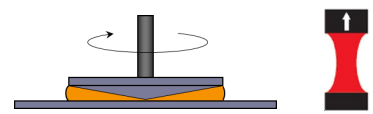
PREREQUISITES: Introductory coursework in fluid mechanics (e.g. ME 310 or TAM 335), or solid mechanics (e.g. TAM 251), or biomechanics, or geomechanics, or polymer physics, or colloid physics, or formulation chemistry, or permission of the instructor.

TEXT:

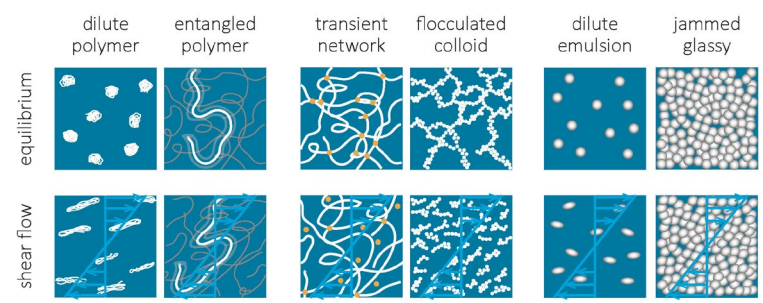
Macosko, Ewoldt, & McKinley: *draft textbook chapters* (provided)



Four key phenomena of rheology (videos) enable many engineering applications (manufacturing, grid-scale energy storage, geophysics, biomedical applications, soft robotics, …)



Measurement: shear and extension flows probe behavior; in-person lab sessions are included in the course



Microstructural explanations will consider polymers, hydrogels, biological fluids, colloidal suspensions, emulsions, foams, pastes, granular physics, and more

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