MECHANICAL & INDUSTRIAL ENGINEERING COLLOQUIUM: ME 794 001

Centrifugal Processing of Soft Material-based Systems

Aaron Mazzeo

Assistant Professor
Department of Mechanical and Aerospace Engineering
Rutgers University, New Brunswick
http://mech2.rutgers.edu/content/aaron-mazzeo
aaron.mazzeo@rutgers.edu

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Abstract
Silicone-based elastomers are the most common class of materials used in the invention of new microfluidic devices and pneumatically driven soft robotic devices. Even though the use of silicone is ubiquitous at the level of discovery, there is a technological gap between making a few devices in the lab and manufacturing microfluidic chips or soft robots at medium-volumes that might meet future demand with appropriate quality, cost, rate, and flexibility of production. To decrease the gap between prototyping and manufacturing, we have focused on processing techniques to move silicone-based prototyping toward industrialization by studying and modeling the physics behind a unique process of centrifugal forming. Centrifugal forming is capable of molding micro features on multiples sides of a part, while controlling the overall thickness. With centrifugal forming, the rate-limiting step of removing bubbles involves a balance of diffusion and buoyancy for bubbles of a critical size. In this talk, we will discuss the removal of bubbles during forming as well as share initial results demonstrating the utility of centrifugal processing for new applications in soft robots. In the final portion of the talk, we will shift toward discussing the use of cellulose-based paper in applications that might have typically involved silicone-based materials. In particular, we will share some work with capacitive sensing to demonstrate the utility of cellulose-based paper in the emerging area of flexible electronics.

Biography:
Aaron Mazzeo is an assistant professor in the Department of Mechanical and Aerospace Engineering at Rutgers University. Prior to joining the faculty at Rutgers, he was a postdoctoral fellow at Harvard University in the Department of Chemistry and Chemical Biology, and he completed his undergraduate (S.B.) and graduate degrees (S.M. and Ph.D.) at MIT in the Department of Mechanical Engineering. He has studied varied topics, such as paper-based electronics and diagnostics, soft robots, acoustic extinction of flames, centrifugal casting and hot embossing of microfluidic devices, and atomic force microscopy. His current research interests focus on advanced manufacturing of soft material-based systems with emphasis in centrifugal processing for coatings, inflatable structures, and disposable flexible electronics.

For More Information Contact: Prof. Shawn Chester: chester@njit.edu