

High Viscosity Printing

David Rosen, Georgia Institute of Technology (USA)

Abstract

Typical commercial ink-jet print heads can eject fluids with viscosities up to 30-40 cP. However, most polymers of interest for mechanical parts have viscosities that are orders of magnitude higher than this; hence there is a need for print heads that can eject high viscosity fluids. After a brief survey, this talk will introduce a high viscosity print head based on an ultrasonic atomizer technology that was developed at Georgia Tech. The bulk of the talk focuses on the development of two types of models: ultrasonic atomizer modeling and droplet impingement modeling.

In the first area, both high fidelity and simplified electro-mechanical models will be presented, with the objective of understanding and improving the pressure gradients in the atomizer nozzle. In the second area, a new Lattice-Boltzmann-based fluids model was developed to simulate droplet impact and droplet interactions in order to determine process conditions that enable the formation of planar films without splash. Implications of the research on printing process and ink developments will be provided. Also, some limits on how high is "high viscosity" will be offered.