Heat and Mass Transport in the Electrospinning Process

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***Abstract*—Electrospinning is a polymeric fiber production technique that is currently being researched for various applications, including membranes and filters, solar cells and fuels cells, tissue engineering and drug delivery. Several models have been developed that depict the mechanics behind electrospinning jets. Many of these models incorporate key principles in their analysis, such as conservation of charge and conservation of momentum, to predict electrospinning behavior. However, these current models disregard the role of heat and mass transfer and tend to assume operating parameters that do not represent typical electrospinning conditions. The objective of this project is to build upon current electrospinning models to include heat and mass transfer principles, environment conditions and realistic electrospinning operating parameters. Furthermore, the goal of the project is to identify the key dimensional parameters that have a significant affect to the control and operation of the electrospinning process. To validate the model, electrospinning and electrospraying experiments were ran for various solutions. At various flowrates, the supply voltage and current from the grounded plate were noted for further dimensionless analysis. Additionally, thermal imaging was utilized for several data sets to highlight the role of heat transfer between the polymeric jet and environment. Also, a microscope digital camera was utilized to capture images of the Taylor cone shape under different operating conditions.**