Polymers are increasingly being used in engineering designs due to their favorable mechanical properties such as high strength to weight ratios, corrosive resistance, manufacturing flexibility. The understanding of the mechanical behavior of these polymers under both static and dynamic loading is critical for their optimal implementation in engineering applications. One such polymer utilized in a wide variety of applications from medical instruments to guided projectiles is Polyetherimide, referred to as Ultem. This thesis characterizes the static and dynamic mechanical behavior of Ultem1000 through experimental methods and numerical simulations. The dynamic response of the material was investigated at very high strain rates using a custom built miniaturized Kolsky bar apparatus. The smaller Kolsky bar configuration was chosen over the conventional Kolsky device to increase the maximum capable strain rates and to reduce common experimental problems such as wave dispersion, friction, and stress equilibrium. The details of the design, construction, and experimental procedures of the Kolsky bar device are provided due to commercial unavailability and lack of a universal test standard for this apparatus. Quasi-static compression experiments of specimens ranging in diameter from the standard 12.7 mm down to 1.83 mm were conducted to investigate the size effects on the mechanical properties. Explicit numerical simulations of the Kolsky bars and specimen were conducted in LS-DYNA to verify the validity of the experimental results.

Major: Mechanical Engineering

Educational Career:
Bachelor’s of Mechanical Engineering, BS, 2010, University of Central Florida

Committee in Charge:
Dr. Ali Gordon, Chair, MMAE
Dr. Seetha Raghavan, MMAE
Dr. Cheryl Xu, MMAE

Approved for distribution by Dr. Ali Gordon, Committee Chair, on March 1, 2012.

The public is welcome to attend.