

## Additive Manufacturing as an Alternative to Injection Molding: A Comparison of Flammability and Fatigue Performance

Jane Spikowski, Dr. Jason Zhu, Thomas Hughes, Roger Avakian, Dr. Jing Liu, Dr. Ray Harrell, Dr. Shih-Wah Wang, Dr. Patricia Hubbard

Additive manufacturing, or 3D Printing, is growing rapidly due to the increased design flexibility and customization capability. For thermoplastic polymers, fused deposition modeling (FDM) has been used to create parts ranging from prosthetic limbs to advanced electronics systems to aircraft components. As this manufacturing technology moves from a novelty to a viable production method, designers must understand the performance differences between parts made via additive manufacturing and traditional production methods.

In this work, two key performance characteristics used in the design of thermoplastic components – fatigue behavior and flammability performance - were studied. Fatigue behavior of polyetherimide / polycarbonate (PEI/PC) blends were compared for injection molded specimens of two different molding conditions and FDM-produced specimens prepared using printing parameters to observe effects of anisotropy and porosity. Flammability behavior was studied in the same PEI / PC blend, along with a polylactic acid blend formulated specifically to meet flammability requirements of electronics applications.

## Nothing Ventured, Nothing Gained

If you don't take a risk, you won't get a reward. This proverb holds true in all aspects of life, whether personal or business. As a person who grew up in a risk-free household, the presenter will discuss learning to take risks and how to ensure the rewards are achieved.

- Landing the job of your dreams, winning plum assignments, and knowing when to move on
- Developing a passion for what you do
- Building a compelling business vision
- Pushing a new product through to commercialization

Dr. Patricia Hubbard is the Vice President of Corporate Technology at PolyOne Corporation, the world's premier provider of specialty polymer materials, services and solutions. In this role, Dr. Hubbard is responsible for leading breakthrough innovation to drive growth through new products.

Dr. Hubbard began her career formulating architectural and container coatings formulations at ICI Paints. In 1997, she joined General Electric, where she held roles in their Plastics, Silicones and Quartz businesses. At GE, Dr. Hubbard successfully led global product and process development teams in diverse disciplines of material science including engineered thermoplastics, silicone fluids, and ceramic chemical vapor deposition. Dr. Hubbard moved to PolyOne in 2007 as the Technology Director for the Specialty Engineered Materials business, and in the past 9 years, led the transformation from a commodity to specialty product portfolio. She moved into her current role in 2015 to drive company-wide product innovation.

Dr. Hubbard earned her bachelor's degree in chemistry from Case Western Reserve University and her Ph.D. in polymer science from the University of Akron. She is a certified Six Sigma Black Belt, and currently serves on the Board of Directors for the Boys & Girls Club of Lorain County.