

Self-extinguishing additive manufacturing filament from a unique combination of polylactic acid and a polyelectrolyte complex

Thomas J. Kolibaba¹, Chin-Cheng Shih², Simone T. Lazar¹, Bruce L. Tai², Jaime C. Grunlan^{2, 1}

1. Chemistry, Texas A&M University, College Station, TX, United States.

2. Mechanical Engineering, Texas A&M University College Station, College Station, TX, United States.

Additive manufacturing, also known as 3D printing, has quickly become a widely used tool for rapid prototyping of complex parts. Most of the common filaments for the fused filament fabrication form of 3D printing are inherently flammable thermoplastics, which has led to numerous fires that pose a serious danger to lives and property. In an effort to improve the safety of these filaments, a unique composite of polylactic acid (PLA) and a flame-retardant polyelectrolyte complex, consisting of poly(vinylamine) and poly(sodium phosphate), was developed. This composite filament can be printed using an ordinary 3D printer under identical conditions to neat PLA. The filament and its printed parts are self-extinguishing in an open flame tests and exhibit a 42% lower peak heat release rate, as measured by microscale combustion calorimetry. This unique filament concept solves a major safety problem for 3D printing and could be extended to other commonly used polymer filaments.

