

# Polymer Engineering and Science

## Effect of expandable graphite on thermal and flammability properties of poly(lactic acid)-starch/poly(E-caprolactone) blend systems

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### Abstract

The effect of expandable graphite (EG) on the flammability and thermal stability of a poly(lactic acid) (PLA)-starch/poly(E-caprolactone) (PCL) blend was investigated. The samples were prepared by melt-mixing and characterized by thermogravimetric analysis (TGA), simultaneous TGA-Fourier transform infrared spectroscopy and cone calorimetry. The char residues of the composites after combustion in the cone calorimeter were analyzed with environmental scanning electron microscopy (ESEM). The thermal degradation stability of the composites was improved and the char content was found to be increased. The flammability performance results indicated that the PLA-starch/PCL blend was successfully modified with the EG micro-filler to obtain fire resistant composites, especially at high filler loadings, due to the formation of an intumescent carbonaceous char. This was confirmed by reductions of up to 64% in both the peak heat release rate (PHRR) and the total smoke release (TSR), and 54% in the specific extinction area (SEA). This is due to the EG acting mainly through a physical mode by cooling and fuel dilution, and through the formation of an intumescent char layer. However, the effective heat of combustion (EHC) and carbon monoxide (CO) yields did not favorably improve.