Synthesis and Processing of Deoxybenzoin-based Polymers with Low Flammability

Todd Emrick, Thangamani Ranganathan, Bon-Cheol Ku, Richard J. Farris, and E. Bryan Coughlin, Polymer Science & Engineering Department, University of Massachusetts
120 Governors Drive, Amherst, MA 01003.

Flame retardants are required to reduce the flammability of polymer materials used in various commercial applications, including materials for aircraft cabins. The widely-employed halogenated flame-retardant additives are less than ideal, due to concerns associated with their environmental and bio-accumulation. Thus, there is a pressing need for new inherently flame-resistant polymers that are halogen-free, and possess low heat release capacities and high char yields. Deoxybenzoin-containing polymers represent one such candidate, as they possess high char yields, due to thermally-induced rearrangement chemistry that leads to diphenylacetylene precursors to char. In this presentation, the use of the bisphenol of deoxybenzoin (4,4'-bishydroxydeoxybenzoin or BHDB) in polycondensation chemistry will be described. Aromatic polyesters from BHDB exhibit low heat release capacity (HRC) of 65 J/g-K and a high char yield of 45%. BHDB-containing polyphosphonates possess similar thermal properties but better solubility and processibility, while poly(arylate-co-phosphonate) copolymers combine the advantageous properties of the two. Processing BHDB polymers by conventional solution and melt methods, as well as electrospray methods for nanofiber formation, will also be discussed.