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Editorial: Sustainable Flame Retardants and Polymeric Materials

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Editorial on the Research Topic

Sustainable Flame Retardants and Polymeric Materials

Due to increasing environmental consciousness and the gradual depletion of fossil resources, growing concerns have led to the development of novel routes for the utilization of sustainable resources to produce polymeric materials and other useful chemicals. For example, bio-derived materials from renewable resources like polylactic acid have been recognized as a promising and environmentally friendly alternative to petroleum-based plastics, and waste recycled plastics like poly(ethylene terephalate) can reduce white pollution and make full use of resources. However, most of these sustainable polymeric materials are inflammable, which brings about a potential fire threat and limits their application in practice. It is necessary and urgent to expand their application by improving their fire safety.

This research topic on sustainable flame retardants and polymeric materials aims to feature the latest prospects in sustainable flame-retardant materials. It includes discussion of applying flame retardants into renewable or recycled polymeric materials, and the synthesis and application of new flame retardant additives produced from sustainable chemicals. Different flame retardant mechanisms in the condensed phase or gas phase are covered. The topic of our special issue delivers greener strategies for flame retarding polymeric materials, which is quite attractive for experts and scholars working on sustainable materials science, high-performance polymers, flame retardancy, etc.

This series includes five research articles that cover flame retardant polymer materials including polyurethane foam (Zheng et al.; Yang and Shao), bamboo material (Lin et al.; Lin et al.), and poly(butylene succinate) (Wang et al.). One review is also included in this series about the application of solid waste in the flame retardant field (Gao et al.).

Zheng et al. synthesized silica aerogel nanoparticles immobilized with 9,10-dihydro-9-oxa-10-phosphaphenanthrene-1-oxide. They were used as a flame retardant to improve thermal stability and fire safety by catalyzing the formation of carbonaceous carbon on the surface of polyurethane foams.

Lin et al. treated flammable bamboo slices with melamine (MEL) and phytic acid (PA) using layer-by-layer (LBL) assembly technology to improve its flame retardancy properties. The formation of thermally stable char with excellent thermal resistance performed a vital role in suppressing flame spread and heat release.

Lin et al. presented a green strategy for the improvement of the flame retardancy of bamboo materials through the self-assembly of PA and polyethyleneimine (PEI). The treated bamboo specimen showed an increased fire performance index and decreased CO and CO_2 yields.

He et al. designed a modified ammonium polyphosphate (APP) with a novel phosphorus-containing organosilicon compound (PCOC), which had a greater charring ability and better flame-retardant properties than unmodified APP in as-prepared rigid polyurethane foam.

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Wang et al. fabricated poly(butylene succinate)/diethylphosphinate (PBS/AlPi) composites. The data show that the use of AlPi endows PBS with an improved flame retardancy without seriously sacrificing other comprehensive performances.

Gao et al. reviewed the recent development of waste flame retardants and their impacts on thermal stability, flame retardancy, and smoke suppression of polymers, followed by representative flame-retardant mechanisms.

In summary, these contributions offer effective green strategies for improving the flame retardancy of materials from both synthetic and natural polymers and offer guidance for the field of sustainable flame retardants and polymeric materials.

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All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication. YZ wrote the manuscript; PS and YL revised the manuscript.

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