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Flame retardancy of rice straw-polyethylene composites affected by *in situ* polymerization of ammonium polyphosphate/silica

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ABSTRACT: Rice straw was modified by *in situ* polymerization of ammonium polyphosphate (APP) polyelectrolyte. FTIR and SEM results indicated that APP polyelectrolyte was grafted into rice straw surface and attracted silica granules. APP polyelectrolyte showed a uniform distribution on surface of rice straw. Composites containing high-density polyethylene (HDPE) and the modified rice straw with APP polyelectrolyte were prepared. By incorporating APP polyelectrolyte of 15 wt%, limited oxygen index (LOI) of rice straw-HDPE composites (RPCs) reached to 23.5%. Introducing neat rice straw to HDPE resulted in a reduction in peak heat release rate (pHRR) of 563.7 kW/m² for RPCs compared with 1223.8 kW/m² for pure HDPE. For RPCs with APP polyelectrolyte of 15 wt%, pHRR reached to 488.4 kW/m². An intumescent, stable, and compact char layer, consisting of P-C, P-N-C, C=C, Si-O-P, and Si-P, resulted in an improvement on flame retardancy of RPCs.

Keywords: A. Polymer-matrix composites (PMCs); A. Natural fibers; B. Flame retardancy; D. Microstructural analysis.

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