**Supporting Information**

Green synthesis of biobased P-N coating via mechanochemistry strategy: For high-efficiency flame retardant finish of cotton fabric

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**Characterizations.** Scanning electron microscopy (SEM, Regulus8100, Hitachi) and energy dispersive X-ray spectrometry (EDX) were used to observe the morphological features. The LFPN suspension was uniformly coated on the smooth aluminum foil surface and naturally dried.

Transmission electron microscope (TEM, HT7800, Hitachi) was used to investigate the submicroscopic structure and spatial form of LFPN.

Wide-angle X-ray diffraction test (XRD, Xeuss 2.0, Xenocs) was used to analyze the crystal patterns of LF, APP, LFPN, Cotton and Cotton-LFPN. The scanning range was 5~50 °, and the scanning rate was set as 2 °/min.

X-ray photoelectron spectroscopy (XPS, ESCALAB XI+, Thermo Fischer) was used to analyze some elements bonding status of LF and LFPN, with a monochromatic Al Kα X-ray source at an acceleration voltage of 15kV.

Fourier transform infrared measurement (FT-IR, IR Affinity-1, Shimadzu) was used to measure FT-IR spectra of surface composition of samples in 500-4000cm-1.

Thermogravimetric analysis (TGA, DT-50, Setaram) was used to analyze thermostability and pyrolysis process of samples. Under the N2 atmosphere, about 10.0 mg of samples within crucible (Al2O3) were heated from 35 to 750 ℃ (20 K/min).

Cone calorimeter (CCT, 6810 with Servomex paramagnetic oxygen analyzer, VOUCH), the improved vertical flammability test (IVFT), and micro-combustion calorimeter (MCC-2, Govmark) were used to analyze combustibility and burning behavior. Every specimen of CCT was composed of three pieces of cotton fabric, which was in size of 100×100 mm2, stacked together, then was wrapped in aluminum foil and exposed to a heat flux of 25 kW/m2. Samples of MCC were heated from 65 to 750 ℃, with a heating rate of 1 ℃/s, under N2 and O2 mixture with a flow rate of 80 and 20 cc/min, respectively. In the IVFT, the size of the selected quadrate fabric was 100×100 mm2. And the ignition location was from the corner of the fabric. Most importantly, both vertical and horizontal combustion behavior could be obtained from the IVFT test simultaneously, which was much closer to the real combustion process than the traditional VFT.

Thermogravimetric-Infrared-Gas Chromatography/Mass Spectrometry (TG-IR-GC/MS, TGA8000-Spectrum Two-ClarusSQ8, Perkin Elmer) was used to analyze change of gas phase of pyrolysis process. The cotton fabric and treated cotton fabric were heated from 30 to 750 ℃ with a heating rate of 20 K/min. High purity N2 was used as the carrier gas to flow through the system of the TG-FTIR-GC/MS device before, during and after pyrolysis. The pyrolysis gas of TG entered the FTIR spectrometer through the connecting tube. After being detected by the FTIR spectrometer, the flow was swept into the cell of the GC/MS to analyze composition of gas phase at maximum decomposition rate.

Laser Raman spectroscopy (LRS, inVia, Renishaw) was collected, with a 532 nm wavelength argon laser line, to detect the degree of graphitization of sample which was from the surface of char residue layer after CCT.