Preparation and application of MOFs-based composite nano-flame retardants in PET

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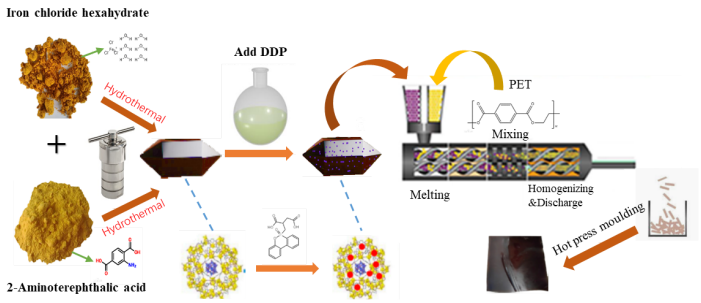
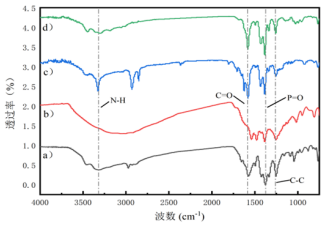
Introduction

The flammability of polymers has been one of the main problems limiting their use/application. The metal in MOFs has the ability to catalyse carbon formation, and the organic ligands are compatible with polymer materials, giving MOFs and their derivatives great potential for flame retardancy. Therefore, we grafted phosphorus-based flame retardants onto the surface of Fe-MOFs to prepare a composite nano-retardant, and then added the MOFs nano-composite flame retardant to PET by melt blending to prepare MOFs flame retardant modified PET composites.

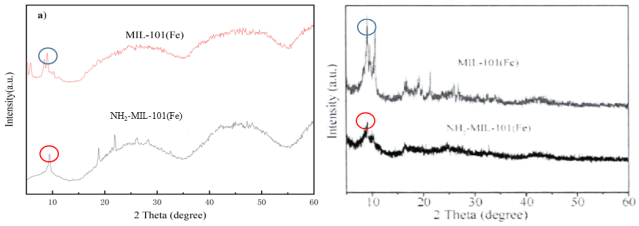
Fabrication process



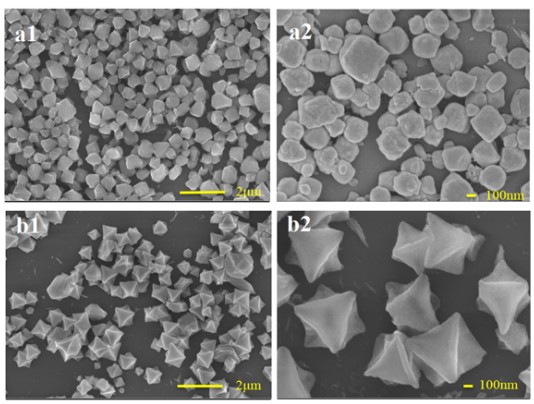
Morphology and structure



a MIL-101(Fe);
b NH_2-MIL-101(Fe);
c NH_2-MIL-101(Fe)@DDP
d NH_2-MIL-101(Fe)@DOPO

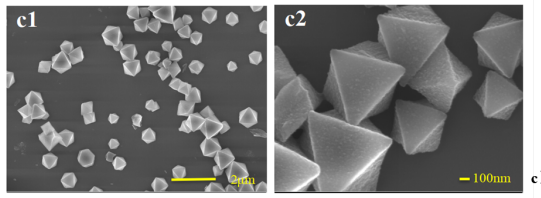


Successful synthesis of MOFs with a specific crystal structure as shown by XRD and FT-IR



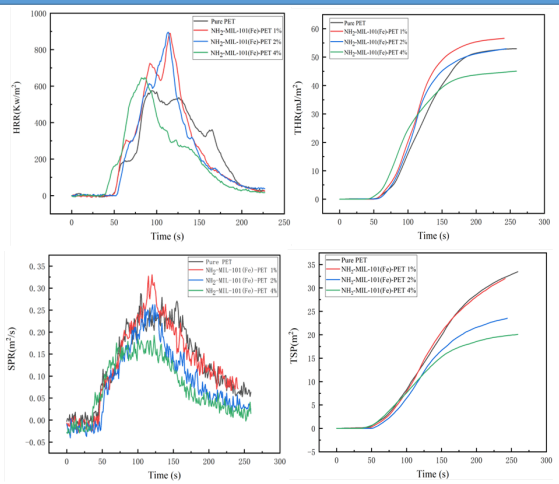
a）MIL-101(Fe)；

b）NH_2-MIL-101(Fe)

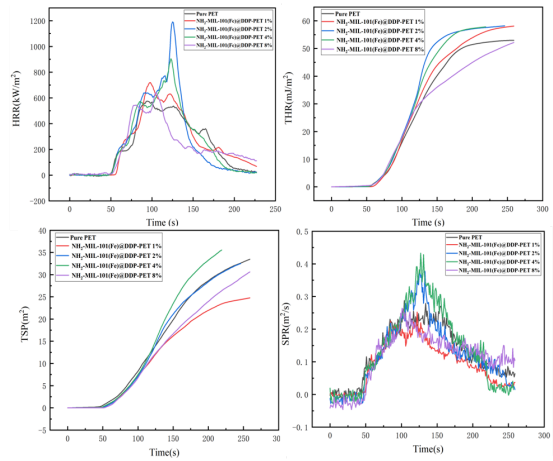


c）NH_2-MIL-101(Fe)@DDP

Performance



CONE test curves for NH_2-MIL-101(Fe)-PET at different flame-retardant additions



CONE test curves for NH_2-MIL-101(Fe)@DDP-PET at different flame-retardant additions

Conclusion

The MIL series MOFs material NH_2-MIL-101(Fe) was synthesised by the solvothermal method and used as a modified precursor to graft the phosphorus-based flame retardant DDP to produce the MOFs nanocomposite flame retardant NH_2-MIL-101(Fe)@DDP, which was melt-blended with PET to obtain a nanocomposite flame retardant polyester. Both NH_2-MIL-101(Fe)-PET and NH_2-MIL-101(Fe)@DDP-PET show good flame retardancy with LOI values of 32% and UL-94 tests up to V-2 level.

References: Aijiao Li, Wenzong Xu, Rui Chen, Yucheng Liu, Wu Li,Composites Part A: Applied Science and Manufacturing, 2018, 112: 558-71.