

材料安全 The Safety of Materials

● 教师介绍 Faculty



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Research Field: Flame retardant polymers/fabrics; Nanocomposites;
Polymer processing; Flame retardant coatings

Education

August, 1993 –August, 1996:

School of Chemical Engineering and Materials Science, Beijing Institute of Technology, Beijing

PhD in Polymer Science

September, 1992 – March, 1995:

Department of Chemical Engineering, the University of Petroleum, Beijing

MS in Applied Chemistry

September, 1988 – June, 1992:

Department of Chemistry, Huazhong University of Science and Technology, Wuhan, China

BS in Chemistry

Work Experience

2006.3-present **Prof. in Polymer Science**, Director of Center for Fire Safety Materials, Beijing University of Chemical Technology

1998.11-2006.2 **Visiting scholar, Research, Part time senior lecturer.** The University of Bolton, UK

1996.12-1998.10 **Vice-director of Research.** Beijing Municipal Chemical Industry Research Institute, China

1988.7-1990.9 **Technician.** Shengli Oil Field, China

Representative Publications

1. Peng Jiang*, **Sheng Zhang***, Serge Bourbigot, Zhilin Chen, Sophie Duquesne, Mathilde Casetta. Surface grafting of sepiolite with a phosphaphenanthrene derivative and its flame-retardant mechanism on PLA nanocomposites. ***Polymer Degradation and Stability***. 2019, 165, 68-79
2. Guowen Ran, Xiaodong Liu, Jia Guo, Jun Sun, Hongfei Li, Xiaoyu Gu*, **Sheng Zhang***. Improving the flame retardancy and water resistance of polylactic acid by introducing polyborosiloxane microencapsulated ammonium polyphosphate. ***Composites Part B: Engineering***. 2019, 173, 106772
3. Xuelian Liu, Jia Guo, Jun Sun, Xiaoyu Gu, Weihua Feng, Wei Liu, Hongfei Li*, **Sheng Zhang***. The preparation of a bisphenol A epoxy resin based ammonium polyphosphate ester and its effect on the char formation of fire resistant transparent coating. ***Progress in Organic Coatings***. 2019, 129, 349-356
4. Xiaodong Liu, Jun Sun, **Sheng Zhang***, Jia Guo, Wufei Tang, Hongfei Li, Xiaoyu Gu. Effects of carboxymethyl chitosan microencapsulated melamine polyphosphate on the flame retardancy and water resistance of thermoplastic polyurethane. ***Polymer Degradation and Stability***. 2019, 160, 168-176
5. Zhengyu Feng, Jia Guo, Yongxin Yan, Jun Sun*, **Sheng Zhang***, Wenjia Wang, Xiaoyu Gu, Hongfei Li. Modification of mesoporous silica with phosphotungstic acid and its effects on the combustion and thermal behavior of polylactic acid composites. ***Polymer Degradation and Stability***. 2019, 160, 24-34
6. Xiaodong Jin, Suping Cui*, Shibing Sun, Xiaoyu Gu, Hongfei Li, Jun Sun, **Sheng Zhang***, and Serge Bourbigot. The Preparation of an Intumescent Flame Retardant by Ion Exchange and Its Application in Polylactic Acid. ***ACS Appl. Polym. Mater.***, 2019, 1 (4), 755-764
7. Xiaodong Liu, Shuang Qin, Hongfei Li, Jun Sun, Xiaoyu Gu, **Sheng Zhang***, Jaime C. Grunlan*. Combination Intumescent and Kaolin - Filled Multilayer Nanocoatings that Reduce Polyurethane Flammability. ***Macromolecular Materials and Engineering***. 2019. 304. 1800531. DOI: 10.1002/ mame.201800531
8. Xiaodong Liu, Jia Guo, Wufei Tang, Jun Sun, Hongfei Li, Xiaoyu Gu, **Sheng Zhang***.

Enhancing the flame retardancy of thermoplastic polyurethane by introducing montmorillonite nanosheets modified with phosphorylated chitosan. **Composites Part A**. 2019, 119, 291-298

9. Xiaodong Jin, Suping Cui, Shibing Sun, Yingliang Tian, Feng Lv, Xiaoyu Gu, Hongfei Li, Jun Sun*, **Sheng Zhang***, Serge Bourbigot. A new approach on improving the fire resistance of Polyamide 11 by incorporating sulfur based flame retardant. **Polymers for Advanced Technologies**, 2019, DOI: 10.1002/ pat. 4591
10. **Sheng Zhang**, Wufei Tang, Limin Li, Jun Sun*, Xiaoyu Gu*, Shou Chen, Xiaohua Peng, Serge Bourbigot. Fabrication of fly ash-based mesoporous aluminosilicate oxides loaded with zinc and its synergistic fire resistancy in polypropylene. **Journal of Vinyl and Additive Technology**. 2019. DOI: 10.1002/ vnl.21726
11. **Zhang Sheng**, Guo Jia, Sun Yongyuan, Lv Zhaoxia, Jin Xiaodong, Liu Xiaodong, Gu Xiaoyu, Li Hongfei, Sun Jun*. Enhancing the Flame Retardancy of Polyamide 6 by Guanidine Sulfamate Modified Carbon Nanoparticles: Carbon Nanotubes versus Graphite Oxide. **Polymer Composites**. 2018, DOI:10.1002/pc.25186
12. **Sheng Zhang**, Xiaodong Liu, Xiaodong Jin, Hongfei Li, Jun Sun*, Xiaoyu Gu *. The novel application of chitosan: Effects of cross-linked chitosan on the fire performance of thermoplastic polyurethane. **Carbohydrate Polymers**. 2018. 189. 313-321
13. **Sheng Zhang**, Wufei Tang, Jia **Gou**, Xiaodong Jin, Hongfei Li, Xiaoyu Gu*, Jun Sun*. Improvement of flame retardancy and thermal stability of polypropylene by P-type hydrated silica aluminate containing lanthanum. **Polymer Degradation and Stability**, 2018, 154, 276-284
14. **Sheng Zhang**, Yongxin Yan, Wenjia Wang, Xiaoyu Gu, Hongfei Li, Jianhua Li, Jun Sun*. Intercalation of phosphotungstic acid into layered double hydroxides by reconstruction method and its application in intumescent flame retardant poly (lactic acid) composites. **Polymer Degradation and Stability**. 2018. 147. 142-150
15. **Sheng Zhang**, Wufei Tang, Jun Sun, Yu Jiang, Xiangxing Bu, Xiaoyu Gu*. Synergistic Effects of Modified Hydrotalcite on Improving the Fire Resistance of

- Ethylene Vinyl Acetate Containing Intumescent Flame Retardants. *Polymer Composites*. 2018. 39(2) 522-528
16. Qingyu Zhang, Wenjia Wang, Xiaoyu Gu, Hongfei Li, Jun Sun J*, Sheng Zhang*. Is there any way to simultaneously enhance both the flame retardancy and toughness of polylactic acid? *Polymer Composites*. 2018. DOI: 10.1002/PC.24764
 17. Sheng Zhang, Wenfei Ji, Yi Han, Xiaoyu Gu, Hongfei Li, Jun Sun*. Flame-retardant expandable polystyrene foams coated with ethanediol-modified melamine-formaldehyde resin and microencapsulated ammonium polyphosphate. *Journal of Applied Polymer Science*. 2018. 135(28) 46471. DOI:10.1002/APP.46471
 18. Sheng Zhang, Xiaodong Jin, Xiaoyu Gu, Chen Chen, Sun J*. The preparation of fully bio-based flame retardant poly(lactic acid) composites containing casein. *Journal of Applied Polymer Science*. 2018. 135 (33). 46599
 19. Xiaoyu Gu, Wenxiang Sun, Jia Guo, Xiangxing Bu, Hongfei Li, Sheng Zhang*, Jun Sun*. Fabrication of hydrotalcite containing N/P/S and its ternary synergistic efficiency on thermostability and fire resistance of ethylene vinyl acetate (EVA). *Journal of Vinyl & Additive Technology*. 2018. DOI: 10.1002/vnl.21684
 20. Wufei Tang, Jinpeng Han, Sheng Zhang, Jun Sun, Hongfei Li, Xiaoyu Gu *. Synthesis of 4A zeolite containing La from kaolinite and its effect on the flammability of polypropylene. DOI: 10.1002/pc.24364. *Polymer Composites*. 2018. 39(10). 3461-3471
 21. Wenxiang Sun, Wufei Tang, Xiaoyu Gu *, Sheng Zhang, Jun Sun, Hongfei Li, Xiaodong Liu. Synergistic effect of kaolinite/halloysite on the flammability and thermostability of polypropylene. *Journal of Applied Polymer Science*. 2018. 135(29) 46507
 22. Yongxin Yan, Xiaoyu Gu, Limin Li, Hongfei Li, Jun Sun*, Sheng Zhang*. Preparation and characterization of intumescent flame retardant biodegradable poly(lactic acid) nanocomposites based on sulfamic acid intercalated layered double hydroxides. *Fibers and Polymers*. 2017. 18(11), 2060-2069

23. Xiaodong Jin, Jun Sun, Xiaoyu Gu, Serge Bourbigot, Hongfei Li, Wufei Tang, **Sheng Zhang***. The preparation of a novel intumescent flame retardant based on supramolecular interactions and its application in polyamide 11. *Applied Materials & Interfaces*. 2017. 29(9), 24964-24975
24. Xiaodong Jin, Xiaoyu Gu, Chen Chen, Wufei Tang, Hongfei Li, Xiaodong Liu, Serge Bourbigot, Jun Sun, **Sheng Zhang***, The fire performance of polylactic acid containing a novel intumescent flame retardant and intercalated layered double hydroxides. *Journal of Materials Science*. 2017, 52, 12235-12250
25. Xiaodong Liu, Xiaoyu Gu, Jun Sun*, **Sheng Zhang***. Preparation and characterization of chitosan derivatives and their application as flame retardants in thermoplastic polyurethane. *Carbohydrate Polymers*, 2017, 167, 356-363
26. Xiaodong Jin, Chen Chen, Jun Sun, **Sheng Zhang***, Xiaoyu Gu. The synergism between melamine and expandable graphite on improving the flame retardancy of polyamide 11. *High Performance Polymers*. 2017. 29(1). 77-86
27. Wei Liu, **Sheng Zhang***, Jun Sun, Xiaoyu Gu, Xinguo Ge. An improved method for the durability of the flame retardant PA66 fabric. *Journal of Thermal Analysis and Calorimetry*. 2017. 128 (1) 193-199
28. Aijuan Wang, Yuzhe Duan, Xiaoyu Gu, **Sheng Zhang***, Wenhui Zang. Surface Modification of Polyamide 66 Fabric by Grafting with Vinyltrimethoxysilane. *Chem. Res. Chin. Univ.*, 2017, 33(3), 492-498
29. **Sheng Zhang**, Xiang xing Bu, Xiaoyu Gu, Jun Sun, Hongfei Li, Wufei Tang. Improving the mechanical properties and flame retardancy of ethylene-vinyl acetate copolymer by introducing bis[3-(triethoxysilyl) propyl] tetrasulfide modified magnesium hydroxide. *Surface and Interface Analysis*. 2017.49(7). 607-614.
30. **Sheng Zhang**, Ying Tian, Xiaoyu Gu, Wufei Tang, Jun Sun*. Improving the flame resistance and thermal conductivity of ethylene-vinyl acetate composites by incorporating hexachlorocyclotriphosphazene-modified graphite and carbon nanotubes. *Polymer Composites*. 2018, 39: E891-E901. DOI: 10.1002/pc.24304.

31. Chen Chen, Xiaoyu Gu, Xiaodong Jin, Jun Sun*, Sheng Zhang*. The effect of chitosan on the flammability and thermal stability of polylactic acid/ammonium polyphosphate biocomposites. *Carbohydrate Polymers*, 2017. 157. 1586-1593
32. Wufei Tang, Sheng Zhang, Jun Sun, Hongfei Li, Xiaodong Liu, Xiaoyu Gu*. Effects of Surface Acid-Activated Kaolinite on the Fire Performance of Polypropylene Composite. *Thermochimica Acta*. 2017. 648(10).1-12
33. Wufei Tang, Hongfei Li, Sheng Zhang, Jun Sun, Xiaoyu Gu*.The intercalation of ammonium sulfamate into kaolinite and its effect on the fire performance of polypropylene. *Journal of Thermoplastic Composite Materials*. 2018. 31(10) 1352-1370
34. Wufei Tang, Sheng Zhang, Xiaoyu Gu*,Jun Sun, Xiaodong Jin,, Hongfei Li. Effects of kaolinite nanoroll on the flammability of polypropylene composites. *Applied Clay Science*. 2016. 132-133, 579-588.
35. Wufei Tang, Sheng Zhang, Xiaoyu Gu*, Jun Sun, Xiaodong Jin, Hongfei Li. Preparation of thiourea intercalated kaolinite and its influence on thermostability and flammability of polypropylene composite. *Journal of Materials Science*, 2017. 52(1) 208-217
36. Bo Cao, Xiaoyu Gu, Xiaohui Song,Xiaodong Jin, Xinyu Liu, Xiaodong Liu, Jun Sun*, Sheng Zhang*. The flammability of expandable polystyrene foams coated with melamine modified urea formaldehyde resin. *Journal of Applied Polymer Science*. 134(5). 2017. DOI: 10.1002/APP.44423

- **课程介绍 About Course**

Public demand for increased safety has led to greater interest in fire retardant materials in the last several decades. Legislation relating to safety continues to produce new regulations. New excellent flame retardant materials are by the use of chemical treatments or additives.

In this course, we consider the material properties first, why materials may need to be fire retarded; how this may be undertaken and the consequences of so doing. This last is particularly important given that the same society that is demanding increased safety is questioning the risks to health and the environment by using flame retardant and fire retardant materials.

Outlines:

1. Introduction (4 hour)

2. Basic concept of materials safety (4 hours)
3. Fire safety of materials (8 hours)
4. Safety of materials for food (2 hours)
5. Safety of materials to environment (2 hours)
6. Safety of materials used in some special application such as military (6 hours)
7. Characterization of material safety (4 hours)
8. Laws, regulations and legislation of material legislation (2 hours)

● **课程大纲 Syllabus**

Instructor: Sheng Zhang, Dr./Prof.

Course Code:

Hours: 32

Credits: 2.0

Prerequisites: Polymer Physics; Polymer Chemistry; Polymer

Description: Public demand for increased safety has led to greater interest in fire retardant materials in the last several decades. Legislation relating to safety continues to produce new regulations. New excellent flame retardant materials are by the use of chemical treatments or additives.

In this course, we consider the material properties first, why materials may need to be fire retarded; how this may be undertaken and the consequences of so doing. This last is particularly important given that the same society that is demanding increased safety is questioning the risks to health and the environment by using flame retardant and fire retardant materials.

References: A.R Horrocks , Danice Price , **Fire retardant materials** , Woodhead Publishing Ltd

General Syllabus:

1. Introduction (2 hour)
The tasks, contents and research methods of material safety.
2. Basic concept of materials safety (4 hours)
Some basic introduction about relative knowledge .
3. Fire safety of materials (8 hours)
The fire hazard is caused by the materials used in our life. For more and more flammable polymeric materials were used in our life, it is important to pay more attention on the fire safety of material.
4. Safety of materials for food (2 hours)
Some materials are used directly in food or in food packaging.
5. Safety of materials to environment (2 hours)
The material used in our life will bring influence to our environment, so we will introduce the different influence from different materials to the environment.
6. Safety of materials used in some special application such as military (6 hours)
Some materials used in military need more guarantee, including flame retardant, anti-explosion and some other special properties.
7. Characterization of material safety (4 hours)

Some basic method to evaluate the safety of material such as FTIR, TGA, LOI, vertical burning test, GC-MASS and CONE, and so on will be introduced in detail.

8. Laws, regulations and legislation of material legislation (2 hours)

At present, more legislation has been focus on the safety of materials, especially in Europe, so some introduction about these work will be introduced.

Grading: Project 20%; Homework 30%; Final exam 50%.

- 教案 **Teaching Plan**
- 视频 **Video**