BRITISH COUNCIL

RESEARCHER LINKS

Newton Fund

Research Profile

Name: **Hesheng Xia**

Position: **Professor & Deputy Director**

Institute/division: **State Key Lab of Polymer Materials Engineering, Sichuan University**

Email: xiahs@scu.edu.cn

Tel: **0086-28-85460535**

SUMMARY OF MY RELEVANT RESEARCH AREAS:

Polymer Micro/Nano-composites: Preparation and Processing

聚合物微、纳米复合材料的制备和加工

Primary Research interests:

In the past ten years, he has been conducting research work on polymer micro/nano-composites; ultrasound mechanochemistry, polymer materials for 3D printing

His main contributions are:

1. He devotes himself to solve the dispersion and structure control of inorganic nanoparticles such carbon nanotubes (CNTs) and graphene (GE) in the polymer matrix through ultrasonic irradiation. (1) the concept and method of ultrasound in-situ emulsion polymerization and bulk polymerization were established and well-dispersed polymer nanocomposites were prepared. This method can solve the dispersion problem of inorganic nanoparticels in the polymer matrix, as well as the interfacial interaction between inorganic nanoparticles and polymer; (2) He established ultrasonically exfoliation, latex mixing and in-situ reduction technology to prepare graphene/polymer composite. The rubber-grapehene composites with uniform dispersion or 3D interconnected graphene network of graphene can be obtained by this method. His findings illustrated the tremendous potential of graphene in natural rubber reinforcement.
2. He developed a novel approach, i.e. using CNTs-wrapped TPU composited powder, combined with the SLS 3D printing technology, to construct electrical conductive nanocomposite.
3. He synthesized a series of ultrasound mechanochemical responsive copolymers and proposed the novel mechanism on breaking copolymer micelle using a mechanochemical way. He established a new modality, i. e. high intensity focused ultrasound (HIFU) remotely controlled drug release.
4. He synthesized ultrasound-responsive polymer containing dynamic bond. Based on those novel materials, he proposed a novel concept and modality, i.e. remotely ultrasound controlled shape recovery and self-healing by employing the thermal effect and mechanochemical effect of ultrasound.

He has published 130 peer-reviewed papers with a citation of 2600 and owned 26 authorized patents. In 2006, he received the Second Grade Prize of National Technology Invention of China and the Third Grade Prize of Science & Technology of Sichuan Province. In 2002, he received the First Grade Prize of Technology Invention, Granted by Ministry of Education of China. His publication was highlighted by “Heart Cut” of ACS and was selected to feature in the RSC supplement news stories

Topics in which you would like to develop collaborative research:

Polymer/Graphene Nanocomposites

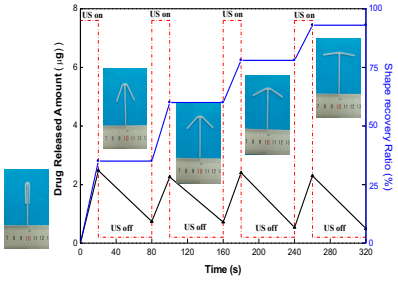
3-d printing of electrically-conductive nanocomposites

Shape Memory & self-healing Polymers

Relevant existing collaborations (academic/clinical/commercial) inside or outside China.

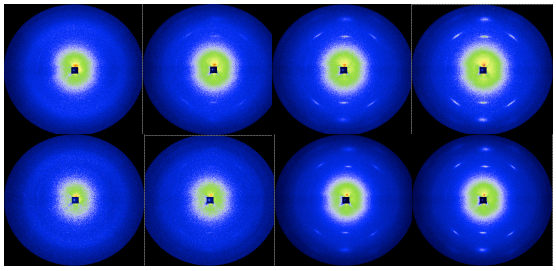
1. Polymer IRC, Bradford University
2. Sinopec Sichuan Vinylon Works, Chongqing, China
3. Southwest Hospital, The Third Military Medical University, Chongqing, China
4. Department of Chemistry, University of Sherbrooke, Canada
5. Institute of Composite and Biomedical Materials, National Research Council of Italy, Naples, Italy

Relevant graphics, figures, pictures:

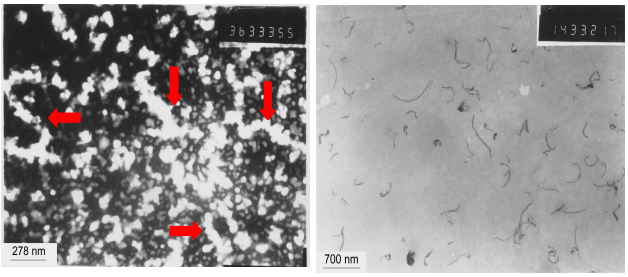


HIFU controlled shape memory polymer and drug release

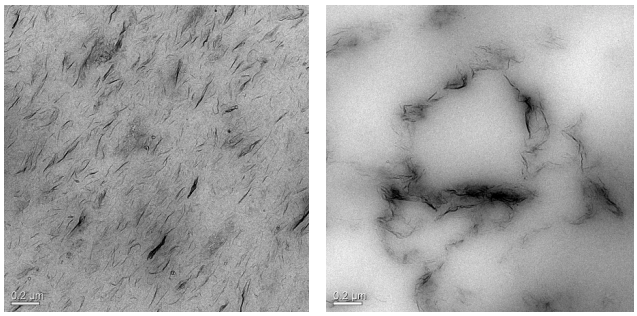
Electrical conductive and flexible PU/CNTs micro-molded parts



2D-XRD patterns of rubber (below) and rubber/GE composites (above) with increasing strains



Polymer/CNTs latex (left) and composite (right)



Rubber/graphene composite

Publications and other outputs relevant to your interest in this programme (up to 5)

1. Hesheng Xia, Yue Zhao, Rui Tong, Ultrasound-Mediated Polymeric Micelle Drug Delivery, Advances in Experimental Medicine and Biology, Therapeutic Ultrasound (book), 2016, 880, 365-384
2. Jian Zhao, Rui Xu, Gaoxing Luo*, Jun Wu, Hesheng Xia*, A Self-Healing, Re-moldable and Biocompatible Crosslinked Polysiloxane Elastomer, J. Mater. Chem. B, 2016, 4, 982—989
3. Qiang Bu, Yanhu Zhan, Fangfang He, Marino Lavorgna and Hesheng Xia*, Stretchable conductive films based on carbon nanomaterials prepared by spray coating, Journal of Applied Polymer Science , 2016, 133(15), 43243
4. Shuchi Liao, Tianliang Zhai, Hesheng Xia*, Highly adsorptive graphene aerogel microsphere with center-diverging microchannels structure, J. Mater. Chem. A, 2016, 4(3), 1068-1077
5. Fayong Li, Chuan Xie, Zhengang Cheng, Hesheng Xia*, Ultrasound responsive block copolymer micelle of poly(ethyleneglycol)–poly(propylene glycol) obtained through click reaction, Ultrasonics Sonochemistry, 2016, 30, 9-17
6. Guo Li, Qiang Yan, Hesheng Xia*, and Yue Zhao*, Therapeutic-Ultrasound-Triggered Shape Memory of a Melamine-Enhanced Poly(vinyl alcohol) Physical Hydrogel. ACS Appl. Mater. Interfaces, 2015, 7 (22), 12067–12073.
7. Dongxu Li, Guoxia Fei, Hesheng Xia*,, Paul E. Spencer* and Philip D. Coates, Micro-contact reconstruction of adjacent carbon nanotubes in polymer matrix through annealing-Induced relaxation of interfacial residual stress and strain. Journal of Applied Polymer Science, 2015, 132(33), 1-11.
8. Dongxu Li, Tianliang Zhai, Qichun Gong, Guoxia Fei and Hesheng Xia*, Effect of Processing Temperature on the Structure and Properties of Microinjection Molded Thermoplastic Polyurethane/Multi-walled Carbon Nanotube Composites, Plastics Rubber and Composites: Macromolecular Engineering, 2015, 44(5), 197-205. (Alan Glanville Award, Institute of Materials, Minerals and Mining).
9. Ning Yan, Filomena Capezzuto, Giovanna G. Buonocore, Marino Lavorgna*, Hesheng Xia*, and Luigi Ambrosio, Gas-Barrier Hybrid Coatings by the Assembly of Novel Poly(vinyl alcohol) and Reduced Graphene Oxide Layers through Cross-Linking with Zirconium Adducts. ACS Appl. Mater. Interfaces, 2015, 7 (40), 22678–22685.