Science Bridges China Research Profile

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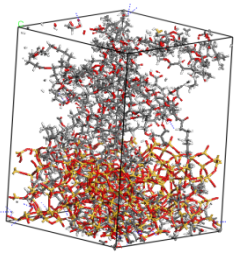
AREAS:

Polymer Nanocomposites; Bioelastomer; Polymer Processing; Rubber Science and Technology

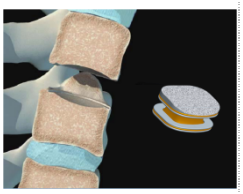
聚合物纳米复合材料；生物弹性体；聚合物加工；橡胶材料科学与工程

Primary Research interests:

1. With the goal of developing the biomaterials applications such as drug delivery matrix materials, tissue engineering scaffolds materials and organ-repairing materials, the research focuses on preparation of novel polymer materials with high elasticity and various biofunctionality. Main research fields are molecular design, synthesis method, structure and property of novel bioelastomer materials, nano-reinforcement and nano-modification of bioelastomer materials, the preparation methods of biodegradable porous scaffolds. Attention is also paid to the time-dependent and environment-dependent properties of the structure and biofunctionality on the bioelastomers as well as cooperation with the hospital on animal experiments and clinical application of bioelastomer materials, etc.



2. Based on the requirement of nation development strategy, such as resource, environment, energy, and so on, we study on the recycling science & technology of the cross-linked rubber, preparation science & technology of energy-saving/ environment friendly/recyclable thermoplastic elastomer, preparation science & technology of advanced material aiming at oil-saving tire. Among these, we emphasize on: science of rubber dynamic vulcanization, science of the crosslink and de-crosslink of rubber, and science of the viscoelasticity and hysteresis of rubber at broad vibration frequency range, and effect of interface on poly-phase, multi-component rubber compounds, and so on.



3. Study on filled elastomer matrix with both high-elastic performance and specific functions such as sound property, luminescence property, electrical conductivity, magnetic property. Focus on the design and development of filler structure and interface structure, the relationship of filler structure and functional response, the relationship of functions and stress, strain, temperature, and other outside fields, and its evolution with time. Develop functional elastomer composites with low-cost and high-performance, develop relevant whole set of product processing technology.
4. Focus on describing and characterizing multi-level and multi-scale structures of nano-dispersion reinforced rubber composites, developing methods of forming random or ordered nano-dispersed structures in rubber matrix, investigating thermodynamics and kinetics of nano dispersion and aggregation using statistical mechanics and molecular simulation methods, mechanism of nano-reinforcement (e.g. modulus, stress, strain, strength), relationship between the complex structure and performance of the nanocomposites, developing industrial low-cost and high- performance nano reinforcement technology and nano-composites.

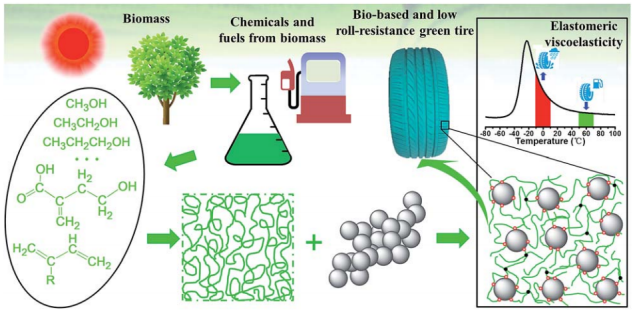
Topics in which you would like to develop collaborative research:

- **Bioelastomer and Water Gels for drug delivery and tissue engineering;**
- **Delicate artificial device for medical application through polymer technology;**
- **Completely biobased polymer blends and composites for health care and environment.**

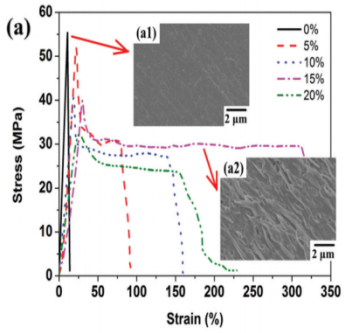
Relevant existing collaborations (academic/clinical/commercial) inside or outside China.

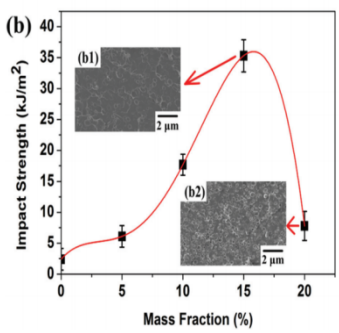
1. Collaborating with over 20 China Enterprises for Rubber Science and Technology
2. Academic Collaboration with Bradford University, Tokyo University of Technology, University of Massachusetts.

Relevant graphics, figures, pictures:

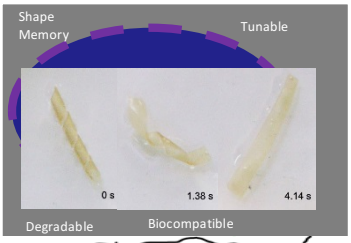


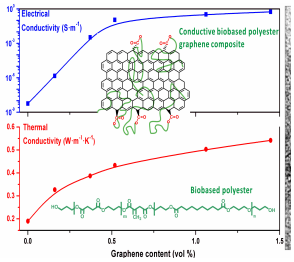
The Concept and routine of Biobased Engineering Elastomer (BEE)

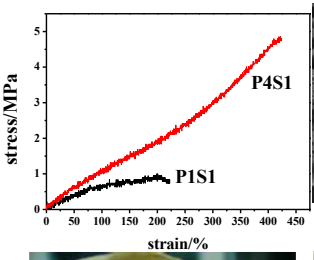


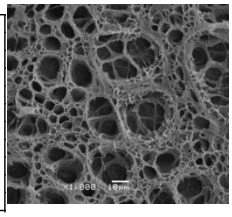


BEE highly toughened PLA blends-totally biobased

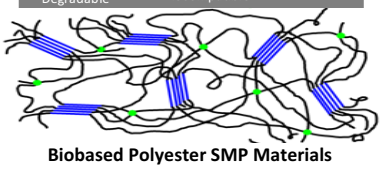




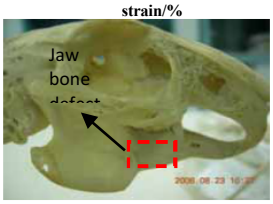


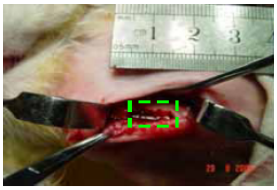


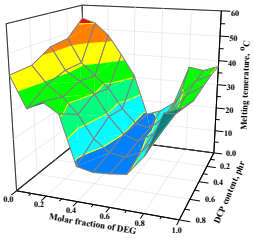
Starch/PVA/ HA system for GTR membrane

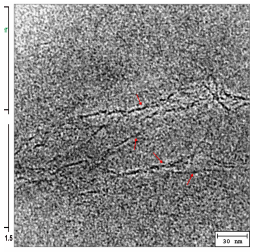


Biobased Polyester SMP Materials









The concurrently increased electrical and thermal conductivity are observed and attributed to the well-dispersion of graphene in BE matrix

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

1. Quanyong Liu, Liqun Zhang, et al. Synthesis, preparation, in vitro degradation and application of novel degradable bioelastomers-A review. Progress in Polymer Science, 2012, 37(5):715-765
2. Jiajia Xue, Phil D Coates, Rui Shi, Liqun Zhang, et al. Drug loaded homogeneous electrospun PCL/gelatin hybrid nanofiber structures for anti-infective tissue regeneration membranes. Biomaterials, 2014, 35(34):9395-9405
3. Jiajia Xue, Liqun Zhang, Yuri Lvov, et al. Electrospun microfiber membranes embedded with drug-loaded clay nanotubes for sustained antimicrobial protection. ACS Nano, 2015, 9(2):1600-1612
4. Xiaoran Hu, Hailan Kang, Liqun Zhang, et al. Direct copolycondensation of biobased elastomers based on lactic acid with tunable and versatile properties. Polymer Chemistry, 2015, 6(47):8112-8123
5. Weiwei Lei, Thomas P. Russell, Runguo Wang, Liqun Zhang, et al. High performance bio-based elastomers: energy efficient and sustainable materials for tires. 2016, 4(34): 13058-13062