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Seminar Presentation by

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Thursday, Sept. 2nd, 2021
11:00am-12:00pm

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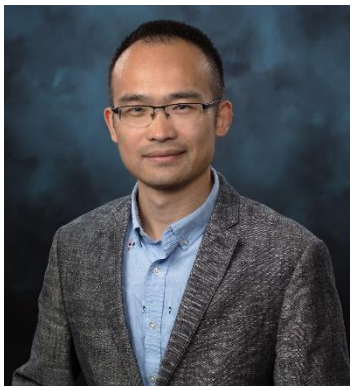
Surpass the Modulus- Extensibility Trade-off of Elastomers: Go Beyond the State-of-Art

Developing high-performance elastomers will not only benefits its current applications like building technologies,[1] automotive and cable coating but also be meaningful in their potential applications including wearable bio-signal monitor, stretchable monitors and battery.[1] The current paradigm of elastomer design is the trade-off between the stiffness and extensibility, which are the two key contributors to toughness.[2] Here, we demonstrated that Young's modulus and extensibility can be simultaneously enhanced by introducing rationally arranged ureidopyrimidone (UPy) units, leading to significantly improved toughness. By tuning the distribution of UPy units along the polymer chains, the formation of UPy clusters within the elastomers as well as the resulted Young's modulus can be effectively modulated without affecting the elongation of the elastomers, which shows great advantage over conventional approaches. With similar strategy, we also developed a series of highly recyclable elastic networks with associative dynamic bonds lying at the polymer backbone. The obtained elastic network shows superior mechanical performance than most of the commercially available elastic networks, like Sylgard and Ecoflex. They can be reprocessed more than 5 times without sacrificing mechanical parameters, including tensile strength and extensibility. The elastic network also shows good resistance over different solvents. Moreover, the elastic network can be used for the fabrication of stretchable sensor, which can also be recycled with functionality being completely recovered.

Bio:



Pengfei Cao is a Staff Scientist at Oak Ridge National Laboratory (ORNL) with expert in the synthetic polymeric materials. Pengfei Cao received his bachelor (2008) and master's degrees (2010) in Chemistry at Tianjin University. After his PhD (2015) in Macromolecular Science and Engineering at Case Western Reserve University, Pengfei Cao moved to ORNL. He currently leads several DOE projects on polymer for building, vehicle and battery applications and he also receive the 2021 ACS-PMSE Young Investigator Award. His current research interests are high-performance elastomers including self-healing elastomer, bio-derived elastomers, adhesive elastomer and recyclable elastomer and synthetic polymers for battery applications like polymer electrolyte, polymeric protective layer.