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Materials Science of Bio-integrated Elecronics

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Abstract: Strategies for bio-integrated electronics must overcome challenges associated with the mismatch between the hard, planar surfaces of brittle semiconductor wafers and the soft, curvilinear tissues of dynamic biological systems. Although soft, flexible electronics have been developed by integrating inorganic functional materials strategically onto soft polymeric substrates, their performance and reliability are usually limited by the failure of stiff electronic materials such as metal, silicon and oxide under large deformation. This talk discusses the successful fabrication and bio-integration of tissue-like electronics that can conform to and deform with biology in an intimate and minimally invasive manner. Three examples of bio-integrated electronics have been developed to manifest the power of such mechanistic understandings. Balloon catheters as minimally invasive surgery tools are instrumented with EKG, temperature and tactile sensors which can survive inflations as large as 200% and are tested within live animal models. As another example, ultra-thin, ultra-soft electronic tattoos are created to achieve conformal contact and compatible deformation with human skin for epidermal sensing and stimulation. Electrotactile actuators integrated on 3D finger tubes are developed to complement wearable sensors for future closed-loop human-machine interfaces.

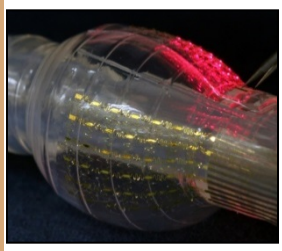
Talk outline:

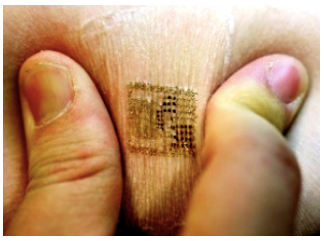
1.Introduction and motivation of bio-integrated electronics

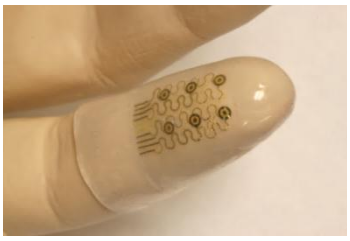
2.Thin film mechanics for flexible electronics

3.Three examples of bio-integrated electronics

4.Conclusion and outlook







Biography: Dr. Lu joined the Department of Aerospace Engineering and Engineering Mechanics at The University of Texas at Austin as an Assistant Professor in August 2011. She received her bachelor's degree in Solid Mechanics from the Department of Engineering Mechanics at Tsinghua University, Beijing in 2005. She obtained her Ph.D. in Mechanics of Materials from Harvard University working with Professors Zhigang Suo and Joost Vlassak in 2009. Dr Lu then received a Beckman Postdoctoral Fellowship and became a postdoctoral researcher working with Professor John Roger at the University of Illinois at Urbana-Champaign. Dr. Lu's research on Epidermal Electronics has been highlighted by news media such as "Nature News", "Science News", "CNN News", and "BBC News" and has brought her awards such as 2012 TR 35 and 2013 Netexplo grand prix.