

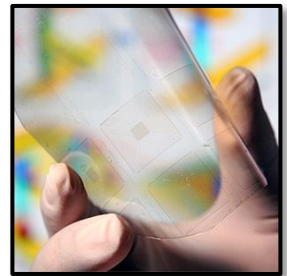
**Semiconductor Research Corporation  
Undergraduate Research Opportunities (SRC URO)**

***Flexible piezotronic transistors array for adaptive and active nanoelectronics***

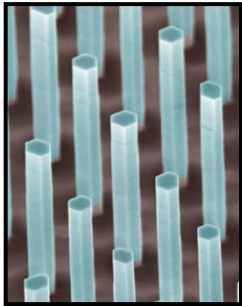
**@ Prof. Wenzhuo Wu's Nanosystems and Nanomanufacturing Group  
School of Industrial Engineering**

**Research Opportunity Description:**

The seamless and adaptive interactions between electronics and their environment (e.g. the human body) are crucial for advancing emerging technologies e.g. wearable devices, implantable sensors, and novel surgical tools. Non-electrical stimuli, e.g. mechanical agitations, are ubiquitous and abundant in these applications for interacting with the electronics. Current scheme of operation not only requires complex integration of heterogeneous components, but also lacks direct interfacing between electronics and mechanical actuations. Piezotronic effect is an emerging field in nanomaterials research and offers novel means of manipulating electronic processes via dynamically tunable strain. The piezotronic principle offers new approach for 3D structuring of vertical nanowire transistor by eliminating the wrap gate electrode. Piezotronics is an emerging field in nanomaterials research and offers novel means of manipulating electronic processes via dynamically tunable strain.



**We have openings for interested and qualified undergraduate students for doing cutting-edge nanoelectronics research.** In the research, we will develop large-scale array of pixel-addressable



flexible and transparent matrix of piezotronic nanowires transistors for active and adaptive bio-electronics sensing and interfacing. The device is capable of self-powered active sensing by converting mechanical stimulations into electrical controlling signals without applied bias, which emulates the physiological operations of mechanoreceptors in biological entities, e.g. hair cells in the cochlea. This research is scientifically novel with transformative impact because it not only dramatically advances fundamental understanding of the emerging research in piezotronics, but also enables new opportunities in designing "smarter" electronics that are capable of interacting with the environment seamlessly and adaptively, which is not available in

existing technologies, for societally pervasive applications in intelligent wearable devices, surgical tools and bio-probes. This research will provide experiences and opportunities for the students to get familiar with the state-of-the-art top-down micro/nano-fabrication and bottom-up nanomaterials synthesis. The students will also learn and carry out the device integration and electrical characterizations the semiconductor nanodevices. The developed piezotronic transistors array will find applications in areas such as human-electronics interfacing, smart skin, robotics, and biomedical treatment.



**Prerequisite:** Basic knowledge in elementary physics, chemistry, and engineering disciplines.

**SRC URO eligibility criteria:** Sophomore (some freshmen may be considered), GPA >3.0, US citizenship, interest in pursuing graduate school

*Interested students should send their resume to Dr. Wenzhuo Wu at  
wenzhuowu@purdue.edu, ASAP*