American Physical Society
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College Park, MD 20740

March Meeting 2023 Featured Presentations
Engineering and Materials Science

Wirelessly Controlling a Venus Flytrap to Grab Objects

March 6, 3:12 p.m. PST, Room 206

Actuators — components responsible for moving parts of machines — are a key element of robotics. Actuators that are soft can perform delicate tasks that rigid actuators cannot, but conventional soft actuators require high power input or are slow to respond. In this talk, Wenlong Li will show how they turned a living Venus flytrap into a soft actuator and developed a new way to operate it, using electrical signals that can be controlled wirelessly with a smartphone. The electrically controlled Venus flytrap actuator is energy efficient and responsive. Li used it to grasp thin wires and even moving objects, showing how plants could be used as sustainable components for robotics.

Simulation Unravels the Mechanical Properties of Knit Fabrics

March 8, 10:48 a.m. PST, Room 130

Different knit fabrics have distinct mechanical properties depending on the stitch patterns and textiles that crafters use to make them. One example of these properties is the ability to store potential energy in materials with diverse fabric structures and geometries when experiencing mechanical strain, such as being stretched. Here, Xiaoxiao Ding and colleagues present a new, physically-validated yarn-level simulation which is able to yield more accurate insights about the strain energy and force responses in knit fabrics. Their talk will delve into how exploring the properties of knit materials is exploitable for designing wearable soft robotics.

Energy-Saving Smart Windows Made With 2D Materials

March 8, 11 a.m. PST, Exhibit Hall (Forum Ballroom)

Materials that can sense and adapt to their environments may be crucial to smart, sustainable architectural designs. During this poster session, Qian Wang and colleagues will present a

new method of making 2D materials like graphene sense and respond to environmental triggers. They demonstrated this method by constructing windows that can open and close automatically in response to small changes in room climate throughout the day, which could be used in energy-saving smart housing. More generally, the work provides insight into the mechanisms behind bending in 2D materials and could also be useful for soft robotics, tissue engineering and other applications.

Ultrafiltration Membranes With Tunable Pores Could Improve Wastewater Reclamation
March 8, 11 a.m. PST, Exhibit Hall (Forum Ballroom)

Water scarcity is a global health concern. Experts consider wastewater reclamation one solution for addressing this issue. But which methods are best for wastewater treatment is still up for debate. In this poster session, Kshitij Sharma and colleagues unveil a methodology for better membrane filtration of wastewater, demonstrating how tuning membranes' pore sizes improves standardized filtration of nonorganic and organic waste. The technique for creating these ultrafiltration membranes could be applied in industrial and municipal settings where waste water disposal is necessary, the team says.

Together, Wearable Sensors and AI Can Detect Early Biomarkers of Heart Disease
March 8, 4:24 p.m. PST, Room 308

Early detection is important in many disorders including cardiovascular disease. Recently scientists have been exploring how artificial intelligence (AI) can be harnessed to detect heart disease and predict associated risks. Here, Anand Babu and colleagues will introduce their novel experimental approach, which synthesized wearable piezoelectric sensors with AI machine learning systems to predict the risk of cardiovascular disease in humans. Tested on 20 subjects with differing body mass indexes (BMIs) and histories of existing heart disease, the device analyzed patterns of arterial pulse to detect biomarkers of heart disease with a prediction accuracy of over 94%. The authors stress that their design could facilitate proactive diagnosis of conditions before they progress beyond the point of recovery.

Propelling Maglev Graphene Vehicles With Lasers
March 22, 6 a.m. PDT, Virtual Room 8

In this talk, Feng Lin and colleagues will present a method of propelling graphene-based materials by illuminating sails attached to them with a laser. They demonstrated their technique with a maglev graphene "boat" suspended in a glass tube of rarefied air, showing

that they could make the boat rotate and control the direction of its rotation. They also showed that they could smoothly and rapidly accelerate a maglev graphene “train” along a track of magnets. The propulsion method could potentially be used for laser-launched rockets or laser-driven vacuum tube trains in the future, the researchers say.