Leslie Morgan / Toyanath Joshi, PH.D

Nano-bridges: Micro to Macro World

Oxides of Vanadium (VOx) grow like a nano-bar structure rather than a film under certain growth condition. The size of the bar is very small, ~1μm in width, and are not visible by naked eyes. We need the aid of a high-resolution microscope to image them.

Nano-bars grown on crystalline substrates are mostly straight. The shape grown on amorphous substrates, however, have a fascinating circular pattern. These nano-bars visually look like ocean and bridge structures in our macro world.

VO_2 (x = 2) has insulator-to-metal transition (IMT) characteristics. This means this material is an insulator at room temperature. But, it behaves like a metal when it is heated to T_{IMT} = 67°C. The insulator-to-metal transition can also be induced by applying an electric field. This ability makes this material applicable to electronic devices such as a current switching element in future generation computer memories (RRAM).

These nano-bars are grown using pulsed laser deposition (PLD) at UCSC, 2300 Delaware research facilities. The plan is to make devices out of these nano-bars and investigate if they are applicable to future generation computing systems.

Elijah Ptotenhauer / Katie Hellier

This piece reflects the tension between our industrial, technologically-focused world and the need for sustainable access to three fundamental things: food, water, and energy. The play between the industrial age - which we are still working our way out of - and the developments we see in sustainability are reflected in the contrast of the cityscape and the life-giving greenhouses and plants at the center of it all. We chose to directly reflect some of the science behind these thoughts through the use of luminescent materials, the symbols incorporated into the design, and the sun overseeing it all.

Katie's research on power generating greenhouses works to address the issue of where to install solar panels. Since the sunniest and best areas for solar also are best for agriculture, having this dual use makes a great use of space. It also addresses the increasing needs of a growing population by generating energy and food while saving water. These solar panels are interesting in how they're designed - giving light to plants while capturing energy. The solar cells don't cover the entire panel, allowing light through to the plants. Where light can pass through, a luminescent dye absorbs green light and turns it into red light (which plants use for photosynthesis). This light is emitted in all directions - some is concentrated onto solar cells and some reaches the plants. This generates energy while making sure plants get the light they need to produce food. Her work also focuses on looking at dyes that absorb other light that plants don't use, creating a variety of colors to be added to the current design.

From Elijah: I'm amazed by how much Katie's work expands on the passions I already have surrounding sustainability and solar energy. Learning more about how it works and this cool way of bringing plants into the mix has been very inspiring. I learned so much about how plants use light that I didn't know and how basic physics can be used in creative ways. I'm very excited to see where this technology takes us.

From Katie: It's easy to get wrapped up in the science we do every day, and forget about applications to the real world. Working with Elijah reminded me about all of the other ways the technology we're working on can be used, and inspired me to think about my work in a new light. His questions were insightful and really probed into what is going on not only in the science, but why we're doing what we're doing. It also gave me ideas on other areas that are in need of research, and encourages me to seek more collaboration across areas in the future.