Engineering researchers study nanostructures from principles to applications

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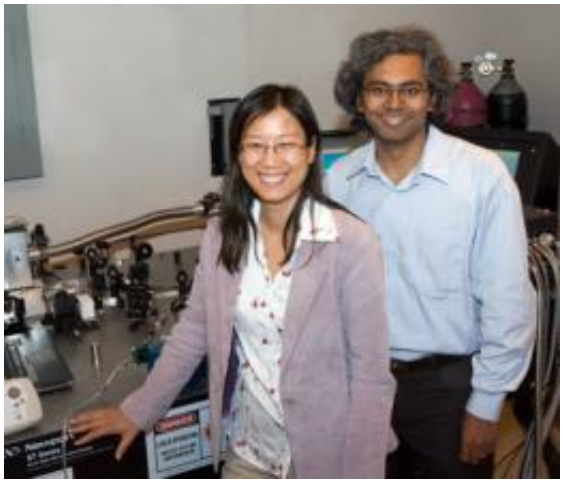

Engineering professors Bo Tan (left) and Krishnan Venkatakrishnan share a lab and a focus on nanostructures, an emerging field of study.

Husband-and-wife researchers Krishnan Venkatakrishnan and Bo Tan are proving that good things really can come in small packages - especially if the package measures one billionth of a metre. Tan is a professor of aerospace engineering while Venkatakrishnan is a professor of mechanical and industrial engineering. The couple met while completing doctoral studies at Nanyang Technological University in Singapore, and today they share a lab - and co-supervise students - at Ryerson.

Personal relationship aside, why collaborate with a mechanical engineering professor when your own expertise is in aerospace engineering? Tan explains: "The process of making an airplane requires many disciplines - physics, electrical engineering and mechanical engineering, to name just a few. Plus, [through multidisciplinary partnerships], the application of my research can go beyond the aerospace industry."

In 2008, both Tan and Venkatakrishnan received Early Researcher Awards from the Ontario Ministry of Research and Innovation for their work in advanced manufacturing research. These days, the researchers are focused on tiny entities called nanostructures. These manufactured configurations of particles, ranging in scale from molecular to microscopic, represent a relatively new area of study - so new in fact, that theories developed today could be disproved just five years from now.

"Our research interests complement each other," says Venkatakrishnan. "My wife is exploring the fundamental principles of nanostructures, whereas I am looking at their applications."

And there are a lot to choose from. For example, Venkatakrishnan and Tan first began studying nanostructures within micro-electronics. More recently, though, the researchers have started developing nanostructures using a variety of materials.

One example: the pair's research on eggshell-based nanostructures - co-authored with Ryerson PhD candidate Amirhossein Tavangar - was published last month in the Journal of Nanobiotechnology. But eggshells aren't the only materials that can support nanostructures; bones and other natural bio-materials are also being studied in Venkatakrishnan and Tan's lab.

Typically, fragile ceramics or rigid polymers are used in surgery to fix broken, old or cancer-damaged bones. Nanostructures embedded within actual bones, however, offer a better solution and can help "glue" deteriorated or fragmented bones back together. Through a biomedical process called tissue scaffolding, a porous, artificially created material is used to simulate real tissue and stimulate new bone growth in the body - something

that other grafting materials are limited in their capacity to do.

Venkatakrishnan and Tan are also investigating how nanostructures can improve the efficiency of solar-energy panels. By decreasing the amount of light that is reflected from a solar panel, nanostructures will enable more solar energy to be converted into electricity.

Finally, the researchers are exploring the use of nanostructures in water-quality monitoring. Acting as sensors, nanostructures can generate signals to indicate the presence of contaminants in drinking water.

To that end, Venkatakrishnan says studying the many potential uses of nanostructures doesn't have to be very complicated. "Other researchers are using complex processes and hugely expensive equipment, but in our lab, we're using a simple concept and it can be applied to many materials."

Provided by Ryerson University