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Nanoimprinting as a size-scalable, high throughput means of creating functional surfaces

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Hierarchical structures with three-dimensional repeated features of two or more distinct length scales at the micro-meter and sub- micrometer scales are becoming increasingly important as a means to offer high-value functionality to material surfaces. The unique surface properties of hierarchical nanostructures are well documented in nature. The lotus leaf, water strider's legs, butterfly wings, feet of geckos, and shark's skin each carry hierarchical structures that impart their respective surface properties of controllable wettability, structural color, reversible (chemical free) adhesion and drag reduction. Nanoimprinting is a cheap, scalable means to achieve high throughput production of functional nanostructures out of a wide variety of materials. Our group has focused on the scaling up of nanoimprint technology to create roll-to-roll imprinted functional anti-reflective and superhydrophobic films with high throughputs of 10 m/min. Through developments that improve our nanoimprint capabilities from various angles: roll-to-roll machinery development, nickel mold fabrication techniques, and development of soft mold nanoimprint processes, our group has been able to create functional films with high yield and fidelity, over areas of to 100 mm x 65 mm with less than 0.2% defects. Further, we have also demonstrated the ability to create a range of hierarchical three-dimensional structures out of a wide variety of nanoimprint compatible thermoplastic and cross-linked materials.

Biography

Tan Wui Siew completed her Ph.D. from Massachusetts Institute of Technology, Program in Polymer Science and Technology, Department of Materials Science and Engineering in 2011. She is currently a research scientist and the deputy head of the patterning and fabrication cluster at the Institute of Materials Science and Engineering, A*STAR in Singapore.

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