Thin-skinned: How to Design Switchable, Conformable, and Three-dimensional Surfaces

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This keynote talk will describe a memory-based, sequential wrinkling process that can transform flat thermoplastic sheets into multi-scale, three-dimensional hierarchical textures. This approach to generate and control wrinkle topographies can produce patterns that mimic those in nature and be integrated into smart materials platforms. Multiple cycles of plasma-mediated polymer skin growth followed by directional strain relief of the substrate can produce hierarchical architectures with independent control over wrinkle wavelength and wrinkle orientation [1]. Such substrates also support switchable wetting properties and all wetting states [2,3]. In addition, we will discuss how a fluoropolymer layer sandwiched between graphene and different polymer substrates can facilitate crack-free and switchable graphene nanostructures [4]. Patterned graphene areas with different curvatures show different reactivities based on plasma fluorination reactions [5] and offer new prospects for conformally wrinkling other two-dimensional materials for optoelectronics and plasmonics applications.

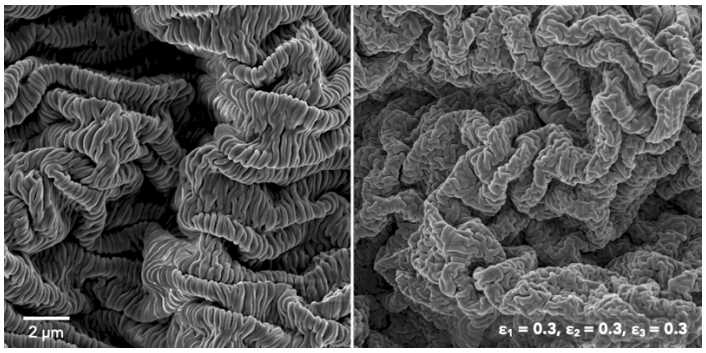

Fig. 1: Hierarchical structures with (left) 1D-2D-2D and (right) 2D-2D-2D wrinkles.

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