

Shaped nanomembranes: From fundamental perception to new concepts and applications

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Abstract- Ultra-thin membranes out of inorganic materials can be easily formed into various shapes and geometries on a single chip. Imagine the following experiment: A compressively strained layer is released from the substrate by e.g. selective underetching. If the layer is homogeneously strained, the film forms wrinkles, whereas it bends if there is a large enough strain gradient across the thickness of the film [1]. We exploit these two phenomena to create large periodic arrays of wrinkled nanochannel arrays and rolled-up micro- and nanotubes. The unique approach to transform a 2D layer system, defined by advanced deposition and lithography techniques, into a 3D object technology [2], opens entirely new perspectives towards reproducible, size scalable and multi-functional components for on- and off-chip applications [3]. We demonstrate ionic sensitive field-effect transistors [4], novel micro- and nanojet engines [5], optofluidic sensors [6], single microtube batteries [7], new concepts for lab-in-a-tube systems [8] and metamaterial fiber optics [9].

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