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Nano/Micropillars for Biological Applications

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The driving force for the recent explosive increase in research on nanomaterials such as nanowires is that nanomaterials possess characteristics that are dramatically different from their corresponding macroscale ones. However, a key to realizing their potential applications for nanodevices is the ability to assemble them into desirable patterned nanostructures. When you search the keyword "nanowire' on google or any professional databases now, you will be amazed to find that the majority of recently publications in this field focused on 'vertical nanowires', i.e. the nanowires are vertically orientated on substrates, but not plain nanowires in solutions or randomly lay on substrates.

In recently years, fabrication and applications of these vertical nanowires, also called nanopillars, or nanowhiskers, have attracted more and more attention. Significant progress has been made in the past few years in fabricating nanopillars, and nanodevices based on nanopillars [1-5]. The materials for these nanopillars include silicon, metals, metal oxide, ceramics, and polymers [6]. The nanopillars, with a broader definition including nanopillars at micro size, i.e. micropillars, not only demonstrated excellent electronic properties, such as as magnetoelectrics, ferroelectrics, spintronics, etc, but also held potentials in a wide range of biological fields. Researchers have found that they can be used for neutron pinning [7], fluorescent imaging, biosensors [8], cell growth adhesions [9], cell isolation [10], DNA purification [11,12] etc.

Although in it infant stage, nanopillars hold great promise for many biological applications. The nanostructures over large areas have important ramifications for many areas of functional device materials. Compared with the lateral interface, the effect of vertical interfaces on the physical properties of substrates is profound.

In the previous years, silicon, metals, metal oxide, ceramics, and polymers have been used to develop nanopilllars. Realization of organic based two-phase, vertical nanocomposites may lead to new forms of ordered nanostructures for multifunctional applications and will open up a new level of control in films so that properties of materials can be tuned by the appropriate choice of materials. This would also enable more straightforward basic research studies of physical property measurements in strained systems to be undertaken.

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