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Nano- and microfabrication technologies for photovoltaic and supercapacitor device applications

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Over the last decades, nano- and microfabrication technologies of semiconductors have received considerable attraction for energy and optoelectronic device applications. Various fabrication techniques such as thermal dewetting, anodization, laser interference lithography, etc., followed by dry etching as well as glancing angle deposition and material growth/synthesis have been employed to create the nano- and microstructures. The fabrication technologies were developed to make something better and cheaper for facile scale-up process, which is easily adaptable to industrial applications. The nano- and microstructures are formed by a combination of several fabrication technologies. Their size and height can be controlled by changing the process parameters. Recently, energy-harvesting devices including different types of solar cells for a sustainable energy source as well as sensing devices such biosensors and photodetectors are very important in the fourth industrial revolution. For use of solar cells, coverglass is typically used during the packaging process. The light trapping in packaged solar cells should be enhanced over a wide wavelength range by overcoming some limitations. Still, the design of the structures and the device performance improvement are required. In this talk, we present the formation of nano- and microstructures of metal oxides (ZnO, TiO2, etc.) by different fabrication techniques including glancing angle deposition and thermal dewetting processes, and the structural and optical characteristics are analyzed. The fabricated structures are applied to photovoltaic and sensing devices to improve the device performance.

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