Development of hierachical macro/mesoporous thin films for solar water splitting

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Development of nanostructured thin films of metal oxide semiconductors having hierarchical arrangement are the most exciting prospect in the material science for optoelectronic application. The hierarchical nanostructured thin films can provide high specific surface area. The hierarchical arrangements represent a critical building block of the nanomaterials which greatly enhances the novel optical, electronic and mechanical properties of the films. Most importantly, these nanostructures offer efficient charge transfer and enhanced light trapping capability through reduced reflection as well as multi-scattering, beneficial for solar light trapping. Several researchers have investigated several *bottom up* approaches on solution methods for the synthesis of hierarchical nanostructured thin films. However, fabrication of the films with tunable control of orientation, surface morphology, repeatability is still a challenge. Herein, we present breath figure assisted solution synthesis of hierarchical macro/mesoporous metal oxide semiconductors thin films with precisely controlled deposition parameters. These approaches are very efficient for the growth of the hierarchical film. In this work, some chemical and physical parameters are found to play key role on growth of the film. We propose to use the film as a photoanodes for photoelectrochemical water splitting and found enhanced photoelectrochemical performance. We demonstrate that the morphologies are beneficial for efficient light trapping as well as efficient charge separation and transport to hamper the charge recombination.