Holographic fabrication of functional nanostructures for efficient sensing applications

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Recently, various periodic nanostructures made of semiconductor materials or metals have been studied extensively due to their potential characteristics for high efficiency optoelectronic/photonic devices. Holographic lithography (HL) has great potential for simple and rapid production of 1D, 2D, and 3D defect-free ordered structures with submicrometer scale periodicity. In HL, multi-beam interference produces multi-dimensional intensity profile of light in space. The interference-induced intensity profile can be transferred to photosensitive materials in very short exposure times. More importantly, HL allows for precise control of the feature size and a variety of lattice symmetries through a proper arrangement of laser beams. In this paper, the fabrication of 3D semiconductor nanostructured materials (ZnO, Cu_2O and TiO_2) is demonstrated by using HL and various inversion processes. We believe that these facile and reliable methods for advanced semiconductor materials can be applied to optoelectronic devices and chemical/biological sensors.