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Metal-assisted chemical etching of silicon and nanotechnology applications

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Abstract Silicon nanostructures exhibit promising application potentials in many fields in comparison with their bulk counterpart or other semiconductor nanostructures. Therefore, the exploiting of controllable fabrication methods of silicon nanostructures, and the exploring of further applications of silicon nanostructures gain extensive attentions. In this review, recent advances in metal-assisted chemical etching of silicon, a low-cost and versatile method enabling fine control over morphology feature of silicon nanostructures, are summarized. The overview concerning the applications of silicon nanostructures in the field of energy conversion and storage, and sensors are also presented.

Introduction

Silicon (Si) has been the most widely used semiconductor for decades, playing important role in the field of electronics, energy conversion, energy storage, and so on. Because of morphological and energetic feature, Si nanostructures exhibit superior performance in many applications in comparison with their bulk counterpart. As a result, researchers are stimulated to exploit methods for the controllable fabrication of Si nanostructures, and explore the application of Si nanostructures.

Various methods have been developed to fabricate Si nanostructures in top-down or bottom-up scheme. Among them, metal-assisted chemical etching (MACE) [1—6] is particularly intriguing and promising, because of its simplicity, good cost-efficiency, and versatility. Various Si nanostructures, for example, Si nanowires (SiNWs), porous SiNWs, Si nanopores, have been successfully fabricated by this facile method, with their morphological features well controlled. A mass of articles have been published in this

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