One-Dimensional Photonic Crystal Electrochemically Etched into Porous InP and Biosensing Applications

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Photonic structures fabricated with line or point defects can be used to guide and trap light with important applications as components in all optical or optoelectronic circuits[1]. While one-dimensional dielectric mirrors are often fabricated as layered heterostructures formed by the alternate or graded deposition of dielectrics with different refractive indices, the porosification of semiconductors is a convenient means of achieving variation in refractive index within a single material. Furthermore, the porous network that is formed functions as an excellent host matrix for different chemical and biological species, and sensors for these molecules have been fabricated from a variety of single- and multilayered porous photonic materials[2].

The adaptation of photonic structures for use in biosensing has been demonstrated previously with electrochemically etched Si materials (see e.g. Ref. [3]). Fabrication of the photonic structure relies on the selective removal of material to generate periodicity within the dielectric, and the most widely studied material for this application has been porous Si. A variety of photonic structures including Bragg stacks, microcavities, and rugate filters can be prepared in Si using galvanostatic or potentiostatic control to generate the desired porosity profile within the dielectric.

Recently, the fabrication of superlattices on n-type (100) InP in HCl-based solutions has been investigated[4]. Based on previous results, it will be discussed in this work the fabrication of one-dimensional photonic crystals consisting of multilayered porous InP obtained by periodic galvanostatic electrochemical etch as well as the ability to use such structures as sensing for biomolecules.

References

[1] J.D. Joannopoulos, *et al*., *Nature*, **386,** 143 (1997).

[2] K.-P.S. Dancil, , D.P. Greiner, and M.J. Sailor, *J. Am. Chem. Soc*., **121**, 7925 (1999).

[3] V. S. Lin, *et al*., *Science*, **278**, 840 (1997).

[4] Tsuchiya, *et al*., *Surf. Sci*., **547**, 268 (2003).