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Structural and Optical properties of ZnO/PS nano composite before and after vacuum annealing treatment

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Abstract : The nanocrystalline ZnO thin film was coated on porous silicon substrate by sol-gel spin coating method. Porous silicon (PS) substrates were prepared by electrochemical anodization on p-type silicon wafers of (100) orientation for various current densities. Surface modification of PS by ZnO and its structural and optical properties before and after vacuum annealing treatment were studied. It is observed that (002) oriented ZnO thin film was formed on PS substrate. It is found that the size of ZnO grains is 49 nm and after vacuum annealing treatment the grain size of ZnO on PS increases from 49 to 61 nm. SEM images show that the pore filling of ZnO on PS. The 493 nm^{-1} stretching mode vibration of ZnO was observed for ZnO/PS nanocomposite. The PL peak intensity increases due to vacuum annealing treatment.
Key words: Porous silicon, ZnO/PS, XRD, SEM, PL, vacuum annealing.

Introduction

In recent years, Silicon based nanocomposites have emerged as a very strong field of research due to their potential applications. The combination of ZnO film and porous silicon substrate would pavethe way for integration of ZnO with Si based optoelectronic devices. Porous silicon (PS) is one of the most important Si-based luminescence materials in the field of research. The quantum-sponge model for porous silicon and the geometrical irregularity play an important role in the optical properties of porous silicon[1, 2]. The porous silicon (PS) structure, with a large surface area matrix, is fabricated through electro chemical etching of single-crystal Si wafer in HF based solution [3].Silicon with various pore sizes is being used in diverse applications such as optical components, gas sensors and micro elctro chemical system (MEMS)[4].The high surface to volume ratio of PS makes it, a possible host material for the precipitation of metals for various applications[1,5].

During the last few years, Zinc oxide emerged as an important oxide material. Zinc oxide is a wide band gap semiconductor with a direct bandgap of 3.3eV at room temperature and exciton binding energy of 60meV [6-8]. ZnO has also gained much interest due to its advantages like good electrical, optical

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