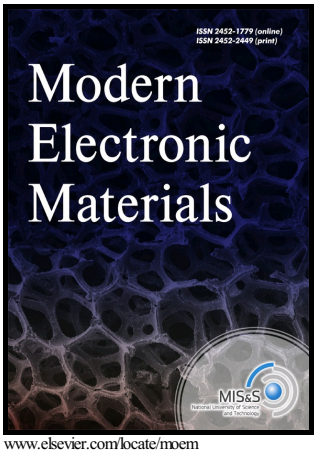

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The effect of surface treatment in polyacrylic acid solution on the photoluminescent properties of porous silicon

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Abstract
Porous silicon (por-Si) has a unique combination of physicochemical parameters: well-developed surface and hence high sorption. Depending on technology it is possible to form nanometer size pores and clusters in porous silicon which makes this material promising for developments in the field of optoelectronics and sensors. However the high surface activity makes por-Si unstable when exposed to atmosphere.
In this work we have studied the effect of por-Si surface treatment in a polyacrylic acid water solution on the composition and photoluminescence (PL) of the material. Por-Si was produced from two fluoric acid solutions. One was a standard solution of fluoric acid, isopropyl alcohol and hydrogen peroxide, and the other was a mixture of fluoric acid and dimethylformamide. We have shown that depending on por-Si technology, its treatment in polyacrylic acid solution allows increasing and stabilizing por-Si PL or changing PL band position and significantly increasing its integral intensity.

Keywords: porous silicon, nanomaterials, electron structure, photoluminescence.

Introduction

Porous silicon (por-Si) is a material with unique physicochemical parameters. It contains multiple pores and has a well-developed surface the specific area of which may be as high as 400–600 m^2/cm^3 [1]. The cross size of the pores ranges from several nanometers to several microns, the thickness of the porous layer reaching several dozens of microns depending on treatment time. The porous layer formed on the surface of the single crystal silicon wafer typically contains nanometer size clusters and quantum wires the surface of which is partially covered with hydrogen atoms and hydroxyl groups. The presence of these complexes in the porous layer seems to account for the relatively intense photoluminescence (PL) of this material in the visible region unlike single crystal silicon [2]. The high specific surface area of por-Si provides for its high sorption which is extremely attractive for the fabrication of sensors [3, 4].