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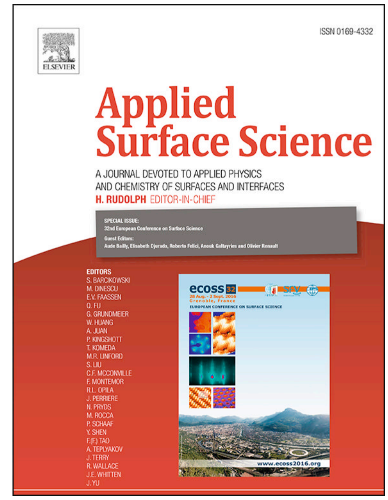

Full Length Article

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Enhancement of porous silicon photoluminescence property by Lithium chloride treatment

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Abstract
Porous silicon (PS) decorated by several nanostructured metal elements has still aroused interests as promising composites in many industrial applications. With the focus mainly on the synthesis, the aspect of stability against optical irradiation of such materials has so far not been thoroughly addressed. This work focuses primarily on the influence of lithium chloride solution (LiCl) treatment on the physical properties of PS. Variations in the structural and optoelectronic properties of PS were observed after immersion in (LiCl), as revealed by the obtained analyses. Moreover, enhanced photoluminescence (PL) property of the PS after passivation by lithium particles was clearly shown, and their presence on the surface of the microporous silicon was confirmed by FTIR spectroscopy and atomic force microscopy. An improvement of the minority carrier lifetime was also obtained, which was attributed to the decrease of the surface recombination velocity after LiCl treatment.

Key words:

Porous silicon, Lithium chloride, photoluminescence, passivation, effective minority carrier lifetime

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1. Introduction

Since the discovery of its photoluminescence properties by Canham in 1990 at room temperature **[1]**, numerous studies have investigated porous silicon in order to develop high performance optical devices, biosensors and optoelectronic light emitting diodes **[2-3]**. Besides its optical properties, PS is considered as a low-cost material possessing a high internal surface which assures a rapid and effective interaction between solvents and gases **[4]** favorable for detection applications. To improve the performances of silicon-based solar cells, PS is integrated as an anti-reflection coating (ARC) permitting the optical losses reduction via light trapping **[5]**. Despite these benefits, the PS integration in final devices is confronted with a lack of stability and reliability. In fact, freshly prepared porous silicon presents at its surface a $Si\text{-}H_x$ termination, which could be subjected to atmospheric oxidation, and consequently, to the appearance of dangling bonds, which may hinder and lead to the degradation of PS performances. In order to obtain stable surfaces, several chemical methods have been proposed to functionalize silicon surface.