



K A U N O
T E C H N O L O G I J O S
U N I V E R S I T E T A S

ISSN 1822-508X

International Conference

RADIATION INTERACTION WITH MATERIAL AND ITS USE IN TECHNOLOGIES 2008

Kaunas, Lithuania

24-27 September, 2008

ISSN 1822-508X

KAUNAS UNIVERSITY OF TECHNOLOGY
VYTAUTAS MAGNUS UNIVERSITY
LITHUANIAN ENERGY INSTITUTE
RIGA TECHNICAL UNIVERSITY

International Conference

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**Kaunas, Lithuania
24-27 September, 2008**

Program and materials

**TECHNOLOGIJA
KAUNAS, 2008**

PROPERTIES OF POROUS Si FABRICATED BY LASER RADIATION AND SUBSEQUENT ELECTROCHEMICAL ETCHING

A. Medvid^{1,2}, P. Onufrijevs¹, L. Fedorenko², J. Rimshans³ E. Dauksta¹

¹ Riga Technical University, Latvia

² Institute of Semiconductor Physics, National Academy of Sciences of Ukraine, Ukraine

³ Institute of Mathematical Sciences and Information Technologies, University of Liepaja, Latvia

Abstract

In this study is to show possibility to use optical recording to store information on porous Si fabricated by pulsed laser radiation and developing of information by electrochemical etching.

Key words: *porous Si, laser, optical storage, chemical etching*

The discovery of strong visible photoluminescence (PL) at room temperature in 1990 from porous silicon (por-Si) [1] has opened the way to worldwide intensive studies on its optical and transport properties and to the numerous technological applications of por-Si in microelectronics and optoelectronics.

There are many methods for fabrication of por-Si. The main method of fabrication por-Si is electrochemical etching of a Si crystal in HF solution with water or ethanol [2]. In this process, on the Si surface deep channels or pores form, with a deep of several micrometers and some nanometres in diameter [3]. Sometimes laser radiation (LR) is used for controlling light emission spectrum or/and stabilize properties of pores. It is known the use of YAG laser fundamental harmonics radiation of the p-type Si before stain etching formation of the por-Si layers [4] after formation of pores [5] or *in situ* electrochemical etching [6]. It is known that formation of pores on n-type Si is impossible due to deficit of holes. In our previous paper [7] we have shown possibility to transform p-type Si in to n-type Si by LR. Therefore it is possible to control rate of chemical reaction by LR.

The aim of this study is to show possibility to use optical recording to store information on porous Si fabricated by pulsed laser radiation and developing of information by electrochemical etching.

The experiments were cared out on p-type Si commercial wafer. At first stage for the optical recording the samples were irradiated by pulsed Nd:YAG

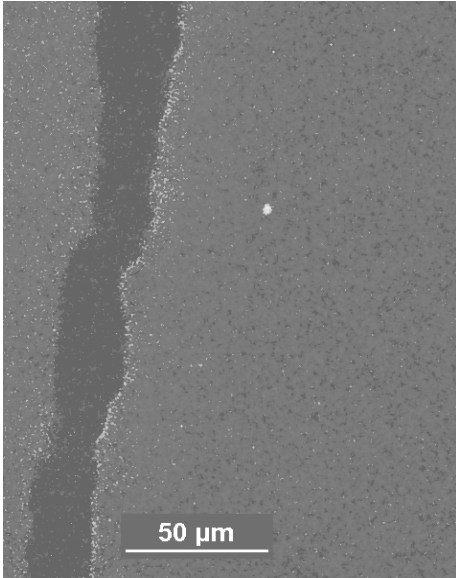


Fig.1. Optical microscopy image of the Si sample after electrochemically etching at irradiation by UV lamp. The black line is irradiated by Nd:YAG laser at $I = 20.0 \text{ MW/cm}^2$.

laser (power $P = 1 \text{ MW}$, wavelength $\lambda = 532 \text{ nm}$ and pulse duration $\tau = 10 \text{ ns}$) at intensities $I_1 = 20.0 \text{ MW/cm}^2$. After irradiation by the laser there were no morphological changes determined. At second stage for the developing of information the samples were electrochemically etched in HF solution (48%) with ethanol in proportion 1:2. Optical microscopy image of the Si sample after electrochemically etching at irradiation by UV lamp with por-Si (non irradiated area - red) and without pores (irradiated area - black) is shown in Fig.1. PL in red part of spectra can be seen by naked eye.

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