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INFLUENCE OF POWERFUL LASER RADIATION ON FORMATION OF PORES IN Si BY ELECTROCHEMICAL ETCHING

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As known, the formation of pores on n-type Si is impossible due to deficit of holes, which play main role in the chemical reaction. In our previous paper [1] we have shown the possibility to transform p-type Si into n-type Si by laser beam (LB). Therefore, it is possible to control rate of chemical reaction, distribution of pores and their size by LB. The aim of this report is to study influence of powerful laser radiation on the formation of pores on a surface of p-Si using electrochemical etching method.

The experiments were carried out on p-type Si(B) commercial wafer. At the first stage samples were irradiated by pulsed N_2 laser (λ=337nm, τ=5ns) at intensities: I_1(area 1)> I_2(area 2)> I_3(area 3)> I_4=70MW/cm^2 (area 4). No morphological changes have been detected during Optical microscope and Atomic force microscope (AFM) studies after irradiation by LB. At the second stage, samples were electrochemically etched for 10 minutes in HF solution (48%) with ethanol in proportion 1:2. PL has been not observed on irradiated and etched sample areas. PL spectrum of the non-irradiated surface was shifted to the red part of spectra with maximum at λ = 650 nm and it was seen by a naked eye under UV lamp. AFM study has showed the formation of pores on the etched surface except irradiated areas where n-type Si formed. After irradiation and etching, area 4 peals to pieces with thickness of 1.5 μm and porous Si appeared below the pealing peaces.

The possibility of electrochemical activity control has been shown. Formation of p-n junction on a surface of p-Si [2], p-Ge [3], InSb [4] and CdTe [5] crystals by laser beam speak in favour of the interstitial mechanism of n-type area formation. One more proof of p-type transformation into n-type Si has been provided.

References:

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