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REDUCING THE THICKNESS OF THE SILICON BASE OF A PHOTO ELECTRICAL DEVICE THROUGH THE APPLICATION OF OPTICAL LAYERS

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ABSTRACT

This paper analyzes the spectral characteristics of light absorption and light reflectance for different thicknesses of silicon base using an optimal multilayer anti-reflection layer.

Recent scientific studies have predicted the possibility of enhancing the absorption of light in the semiconductor layer by the formation of various types of surface and volumetric optical devices in the design of photoelectric devices, and separate studies have been conducted [1]. An important aspect of this idea is that if this idea is implemented, the semiconductor layer that serves as the base can be reduced in return. This in turn saves semiconductor material and reduces the weight of the finished photovoltaic device [2].

Single-layer and multi-layer anti-reflection layers can also be considered as such optical additives. This raises the question of whether it is possible to reduce the thickness of the silicon base layer while maintaining its absorbency. Therefore, a number of studies have been performed in which the spectral characteristics of light absorption and light reflectance for different thicknesses of a silicon base were calculated using an optimal multilayer anti-reflection layer.

Some of the calculations for different thicknesses of crystalline silicon are shown graphically in the following figures (Figure 1). The absorption of light in silicon is shown in Figure 1, and the light transmittance is shown in Figure 2, when there is no anti-reflection layer on the silicon surface.

As the thickness of silicon decreases, according to the law of light absorption [3], the amount of absorption in it also decreases. At the same time, the amount of light passing through the silicon layer increases (Figure 2).

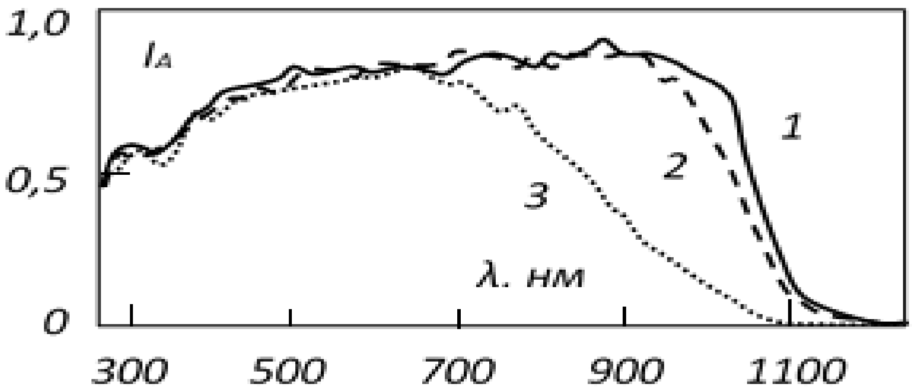

Figure 1. Silicon absorption index of different thickness spectral connection: 1 - d = 200 µm; 2 - d = 100 µm; 3 - d = 10 µm

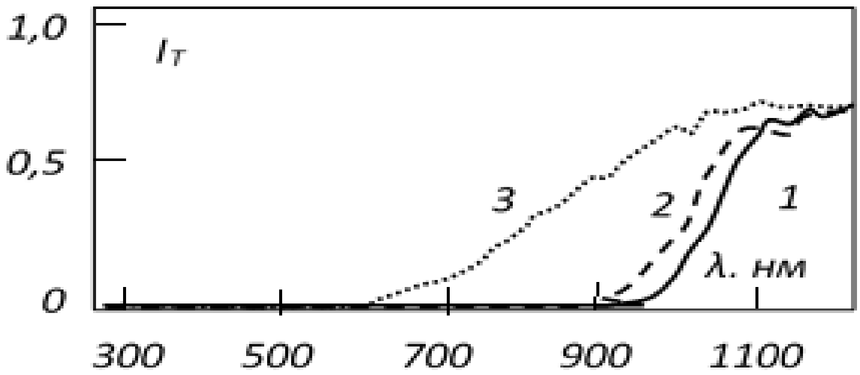

Figure 2. Silicon transmittance of different thicknesses spectral connection: 1 - d = 200 µm; 2 - d = 100 µm; 3 - d = 10 µm

When the surface of the silicon wafer is coated with an anti-reflection layer, the light reflection decreases sharply (28-30%) and the light absorption increases [4]. In our research, light absorption in silicon is significantly improved, but if we reduce the thickness of the silicon base, the amount of transmitted light will also increase. Although the absorption of light in silicon is much higher than in the absence of an anti-reflection layer, a corresponding decrease in absorption is observed as the thickness of the silicon decreases (Figure -3). Repeated calculations have shown that when the thickness of silicon is reduced from 200 microns to almost 150 microns, the change in absorption is very small and is mainly due to the infrared field.

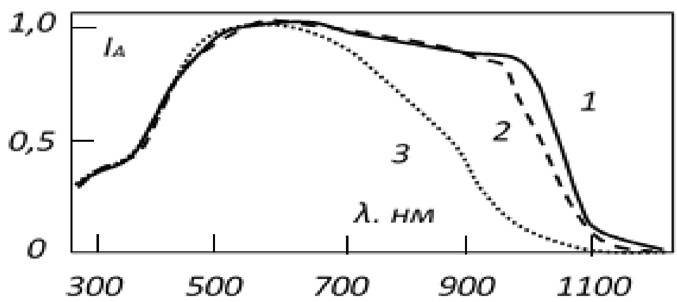

Figure 3. Silicon of different

thickness with a layer on the surface (SiNx, d = 75 nm)
spectral correlation of light absorption index: 1 - d = 200 μm; 2 - d = 100 μm;
3 - d = 10 μm.

In conclusion, it is not enough to consider single- and multi-layer anti-reflective layer structures as additional optical devices sufficient to reduce the silicon base. It turns out that it would be advisable to use textures or other innovative optical solutions to sufficiently reduce the silicon base. The anti-reflection layers serve to reduce the reflection of light in such constructions as well as to passivate the recombination properties of the surface.

References:

1. N.I.Klyuy, V.G.Litovchenko, A.N.Lukyanov, L.V.Neselevskaya, A.V.Sarikov, V.G.Diskin, U.X. Gaziyev, Z.S.Settarova, M.N.Tursunov Vliyaniye usloviy osajdeniya na prosvetlyayushiye svoystva almazopodobnix uglerodnix uglenok dlya solnechnix elementov na osnove kremniY. // Journal of technical physics, 2006, volume 76, vip. 5. S.
2. Jain S, Depauw V, Miljkovic VD et al (2015) Broadband absorption enhancement in ultra-thin crystalline Si solar cells by incorporating metallic and dielectric nanostructures in the back reflector. Prog Photovoltaics Res Appl 23: 1144–1156. doi: 10.1002 / pip.2533
3. L.A.Kosyachenko, YE.V.Grushko, T.I.Mikityuk Pogloshatelnaya sposobnost poluprovodnikov, ispolzuemix v proizvodstve solnechnix paneley. // Physics and technique of semiconductors, 2012, volume 46, vip. 4. S..
4. A.G.Kazanskiy Tonkoplenochniye kremniyeviye solnechniye elementi na gibkix podlojkax. // RENSIT, 2015, TOM 7, NOMER 1, pp.