New surface passivation and local contacts on the backside for thin mc-Si solar cells

P. Vitanov[1], N. LeQuang[2], A. Harizanova[1], O. Nichiporuk[2], T. Ivanova[1], S. Vitanov[3], V. Palankovski[3]

[1]*Central Laboratory of Solar Energy and New Energy Sources,Bulgarian Academy of Sciences, blvd. "Tzarigaradsko chaussee" 72, Sofia, Bulgaria*

[2]*PHOTOWATT International S.A., 33, rue Saint-Honore – Z.L. Champfleuri, 38300 Bourgoin-Jallieu, France*

[3]*AMADEA Group, IμE, TU Vienna, Gusshausstr. 27-29, A 1040 Vienna, Austria*

Silicon solar cells can be produced at lower material cost by reducing the wafer thickness. However, the established methods for backside surface passivation such as full-face aluminum screen printing layer appear not to be suitable for very thin solar cells. Therefore, current research activities focus on alternative concepts. A new thin film of dielectric material $(Al_2O_3)x(TiO_2)_{1-x}$ has been recently proposed. It introduces negative fixed charges at the interface with p-type Si substrates. As a result, a region of strong accumulation is formed and the surface potential is changed. The electric field builds up, leading to a decrease of the surface recombination velocity of minority carriers similar to the back surface field (BSF) effect in the presence of a p^+ region. In this work we compared the experimental results with the two-dimensional device simulations. The usage of a backside dielectric layer with large negative charges for solar cells without p^+ backside region turns out to be a reasonable and cost effective alternative without performance losses.

Surface silicon microstructuring using selective formation of porous silicon for buried contact silicon solar cells

P. Vitanov, E. Goranova, *V. Stavrov, P. Ivanov

Central Laboratory of Solar Energy and New Energy Sources, Bulgarian Academy of Science, 72 Tzarigradsko Chaussee Blvd., 1784 Sofia

**Nanotools Ltd., Botevgrad*

The aim of our work is to develop a new low-cost grooving technique for buried - contact (BC) solar cells. In the existing BC solar cells metal contact fingers are formed in deep grooves made either with a laser or mechanical saw. After scribing the grooves are chemically etched in order to remove the damaged surface layer. These processes are complicated, time consuming and, hence, expensive. Substantial improvements in both cost and efficiency can be achieved by proposed new technique for realization of U-shaped grooves. To form U-grooves porous silicon (PS) has been used as a sacrificial layer. The process sequences include selective formation of PS layer in the contact grid region by anodization technique. The regions with PS were etched off with selective etch solution. After PS removal front contact grooved structure is obtained. The next processing steps are similar to those widely used in solar cells fabrication today: N+ diffusion and oxidation, front contact window opening, metal deposition, passivation and annealing.