Nanostructural surfaces

Influence of polymer nanocomposite coatings on recombination processes in silicon space photovoltaic cells

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Decrease in the recombination rate of nonequilibrium charge carriers (NCC) in the subsurface region is one of the major ways of increasing the efficiency of photovoltaic cells (PVC). Space PVC implies the deposition of a surface protective layer made of borosilicate glass, which can reduce recombination losses from aggressive external factors, such as radiation. The aim of this work is to study the possibility of using cheaper coatings based on epoxyurethane (EU) and polyurethane (PU) and their nanocomposites filled with 0.001-1 % wt of SiO_2 (nEU and nPU) instead of the glass cover. The nanocomposites were formed via synthesis of polysiloxane particles by the *in situ* sol-gel method in the medium of polyoxypropylene glycol and were deposited onto the front surface of the PVCs as coatings. Recombination processes were studied using surface photovoltage (SPV) relaxation technique. The SPV decays are determined by the processes of NCC recombination on the surface and in the bulk of the structure, close to the interface regions.

Analysis of the experimental SPV decay curves allow to conclude that covering the n+|p|p+ PVC surface with the EU polymer layer slows down the decay, whereas the PU coating turns out to accelerate the SPV decay in comparison with the one reproduced in the reference structures without polymer coatings. Meanwhile, nEU coatings accelerate the SPV decays while nPU coatings increase the decay time. It can be suggested that the observed differences in recombination processes in the PVCs with different polymer coatings are due to both the modified parameters of recombination centers at the insulator-semiconductor interface and the structural features of the polymers used.