PROSPECTS FOR THE USE OF THIN-FILM CADMIUM TELLURIDE IN SOLAR ENERGETICS

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S u m m a r y

A comparative analysis of applications to the power engineering of semiconductor solar cells based on crystalline, polycrystalline, and amorphous silicon (Si), as well as thin-film copper–indium–gallium diselenide ($CuIn_xGa_{1-x}Se_2$, CIGS) and cadmium telluride (CdTe). It is shown that the advantages of the thin-film technology and CdTe as a direct-gap semiconductor open the promise of large-scale production of competitive CdTe solar modules. We discuss the physical and technical problems of increasing the efficiency of heterostructure of CdS/CdTe solar cells, which in mass production is much lower than the theoretically possible value. The calculation of the spectral distribution of photoelectric efficiency and short-circuit current is performed using the continuity equation, taking into account the drift and diffusion components of the photocurrent, recombination losses at the front and back surfaces of the CdTe absorbing layer. Dependences of thr open circuit voltage and the filling factor of the current-voltage characteristics under AM1.5 irradiation on the parameters of the diode structure have been found in the frame of the Sah–Noyce–Shockley generation-recombination mechanism supplemented by a diffusion electron current at high voltages. Based on the known optical constants of the materials used, the calculations of optical losses due to reflection from the interfaces and absorption in the CdS layer and semitransparent conductive layer are carried out. It has been shown that, in the typical structure of CdS/CdTe solar cell, optical losses are significant.