

RENEWABLE ENERGY SOURCES

8.3. Solar power plants and heat supply systems

8.3.1. Photoelectric converters and power installations on their basis

8.3.1.3. Thin-film photoconverters and modules

V.A. Vasilyev, B.V. Tarnizhevskiy, OJSC "ENIN"

Simplicity of creating half-conductive structure of SEs, low raw material consumption, application of cheap padings, gaining of solid integral modules during the process of large-scale automatic production, significantly cheapens the process of thin-film (TF) FEM production.

Photo-electric module of amorphous silicon (α -Si) is the thin-film SE of the complicated structure. The basis of its technological production process is the layerwise application of correspondent compounds of thin films by different methods. One of advantages of such modules is its flexibility and lightness (fig.8.10). It is also necessary to mention that their temperature coefficient of capacity reduction is twice as less as of single-crystallized modules. It defines their higher output parameters at increasing of working temperature [18]. But low coefficient of efficiency and significant worsening of module parameters during the process of exploitation does not allow expecting their wide application in power systems.

In spite of the achieved successes of the last years, industrial modules efficiency factor does not exceed 10% for hybrid FEMs of amorphous and micro-crystallized silicon.

Recently, a share of FEMs from α -Si in the world market reduced from 12,3 % in 1999 to 4,7 % in 2005 at the volume of module production of 85 MW [19]. However, a number of firms, for example, Mitsubishi Heavy Industries declared about further significant widening of amorphous module production and bringing production of amorphous modules on the basis of α -Si/ μ -Si to 50 MW per year.

Another large direction in the field of TF transformers of

solar energy, which is actively developed in the limits of national programs and by separate firms, is devoted to working out of FEMs on the basis of CdTe. Application of new materials such as CdTe, for forming the SE structure and optimization of technological process gives a great potential for cutting the cost of serial modules and for increase in their efficiency [20]. The company First Solar plans to increase the output of FEMs on the basis of CdTe from 21 to 100 MW per year.



Fig. 8.10. Flexible small modules of thin-film solar elements

In table 8.6 data of the key manufacturers of thin-film SEs and the gained results are shown.

Table 8.6. Basic characteristics of thin-film SEs

SE structure	Key firm - producers	Average efficiency factor of industrial module, %	Maximal efficiency factor, %	Developer of record SEs
Si amorphous	Kaneca United Solar Ovonic Energy Photo-voltaics	10 7,6 5,8	13	United Solar Ovonic
CdTe	First Solar Antec Solar	10,2 7,3	16,5	
Cu(In, Ga)Se ₂	Wurth Solar Global Solar Shell Solar	11,5 10,2 13,0	19,5	NREL