Future Prospects for Renewable Energy: Solar Photovoltaic Technologies

CODATA task is to develop information methodology, which can help to solve problems of high priority for progress of international science and technology. Renewable energy is undoubtedly in the list of such problems of global importance.

The proposed session will be sponsored by Asia Pacific Academy of Materials (APAM) and devoted to most promising technology of renewable energy - solar photovoltaics (SPhV). solar radiation is an inexhaustible source of energy. At the moment share of SPhV in the world energy balance is less than 1%. It is predicted that by the end of our century this share will exceed 50%. It is clear that this goal can be reached only if efficient cooperation is organized. We believe that such cooperation will be realized and development of SPhV will become the biggest world technical project of 21st century.

It is clear that in this project an information collection, exchange and use is an absolute necessity.

- Solar radiation in different sectors of our globe, areas potential for solar stations of different scale including global networks,

- Existing national programs of SPhV development,

- Materials, required for realization of SPhV projects of different size,

- Problems of specialists training,

- Legal aspects of international cooperation in development of SPhV network

In this session, the following SPhV subjects will be specifically addressed including data of resources of high purity quarta required for production of solar quality silicon; thermodynamic model of materials of SPhV for producing cost effective high efficiency solar cells; the surfaces and interfaces studies to enhance SPhV energy conversion efficiency, for example, problem like fixed oxide charges which should be tailored to retard the surface electrons, which in turn reduces the surface recombination losses; research on the energy transport and conversion on solid surfaces and interfaces in the nanoscale regime; also for the highest efficiency thin film CIGS solar cells, obstacles like deviation from stoichiometry and their effective defect controls have to be resolved and their essential database on defect structures should be established for the ture industrilization.

Also subject on the development of high conversion efficiency Si-base thin-film tandem solar cells are underway. Among various technologies, the Si-based thin-film solar cell has the potential to achieve low production cost. However, further improvement of the conversion efficiency is needed in order to reach the grid parity. We have employed Si-base materials, such as amorphous silicon, silicon oxide or silicon germanium as absorbers to have better spectrum splitting. Moreover, different back reflecting structure was incorporated to improve spectral response significantly. In the presentation, current results of integrating cell materials and back reflecting structures in tandem cells will be presented.

Furthermore, subject on graphene based nanomaterials for wind / photovoltaic / energy storage system are pursuited. The development of Graphene-based nanomaterials for green energy applications will be presented. The strategies for the development of wind turbine include the fabrication of nanocomposite wind turbine blades, power generation work in slight wind, electricity-converting hardware engineering and control system. The photovoltaic system studied for hybrid system focused on the development of dye-sensitized solar cell (DSSC). MWCNTs and Graphene based nanomaterials were used to improve the efficiency of DSSC. The energy storage system investigated including various batteries, especially the Vanadium Redox Battery (VRB) and the supercapacitors. Some promising results will be exhibited.