

## **DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)**

The aim of the project is to obtain the possibility of increasing the efficiency of solar cells by the modification of the incident solar spectrum, so that the largest possible its amount could be used to produce electrical energy. The envisaged effect is to be obtained by the use of layers which convert the energy of the incident solar radiation that hits the cell. Namely high energy photons of ultraviolet light (UV), are to be converted (in a ratio of 1: 1 or 1: 2) into the photons of lower energies from the visible light range, which are more efficiently used in photovoltaic conversion process. This efficiency could be up to twice as high in the case of obtaining two low-energy photons out of one high-energy photon. This conversion, so called *down conversion*, will be achieved through the use of layers containing zinc oxide (ZnO) nanoparticles.

In the framework of the project it is envisaged to design and manufacture of test solar cells' structures of various types, which would contain energy converting layers based on ZnO nanoparticles, including polycrystalline silicon solar cell as a basic structure.

Tasks which are planned to be realized within the project include both theoretical and practical research concerning the implementation of ZnO nanoparticle layers in solar cells of different types. Theoretical tasks will contain: the development of numerical models and computer simulations, which will verify the expected properties of the new photovoltaic structures. Experimental research will allow the verification of the parameters of new construction types of photovoltaic structures with proposed energy converters. Optical and electrical properties of the converting layers and the final structures of photovoltaic cells will be examined and compared with parameters of conventional solar cells made in the same technology.

The solution proposed in the project is an alternative approach concerning the subject of improving the efficiency of photoconversion in conventional semiconductor solar cells. Here, instead of modifying the design or material structure of the cell an adjustment of the incident light spectrum is proposed. The method to realize this idea is the use of an original photoluminescent layer, which, after absorbing sunlight emits light at well-defined wavelengths.

The reason for choosing this research topic is an intensive development of photovoltaics in recent years, which is connected with extensive studies in this field. The research are focused on achieving low-cost photovoltaic devices which could directly compete with the conventional energy sources. This requires the development of effective and easy-to-implement technology that would also deliver relatively high efficiency of elements. On the other hand, for the dissemination of photovoltaics reliability and suitably long life of cells, modules and photovoltaic components is essential to make them capable of providing lifetime of sufficient reference to the economic benefit of the investment. Simultaneously, through the introduction of innovative solutions, it is possible to significantly expand the area of solar cells' application. The project concerns directly the above mentioned problems and is important both because of the cognitive, scientific and technical values, as well as opportunities to develop photovoltaic technology in Poland.