**Physical background of nanostructured silicon-based systems solar cells with phase-change fillers**

1. **The goal of the project**

To improve understanding of thermal transport at the interface “solid state/phase change materials” and to develop the physical basis for utilization of phase change materials for cooling of sola cells and to further accumulation of the thermal energy excess.

**2. Introduction**

Currently, the use of the renewable source of energy started to be crucial for the society. Among different approaches directed for the resolution of this issues, one can mentioned the use of solar energy. Particularly, the solar energy can be directly converted in electrical one with the solar cell or in thermal one with solar concentrators. The main advantages of such approach is wide accessibility of such technologies for almost all regions worldwide, and the energy can be mining locally to the place of consummation. As a result, photovoltaic is one of the most developed field among different renewable energy approaches.

The new generation of photovoltaic convertors, that contain multicomponent and typically based on the usage of nanomaterials, have a significantly improved efficiency. However, for such systems the maintaining of temperature regime is significant issue. And the overheating can significantly reduce performance and lifetime of the systems. Therefore, liquid cooling is often used to overcome this issue. Nevertheless, the new physical insight regarding thermal transport across nanostructured solid/liquid interface is crucial for further improvement of thermal management in the solar cells.

From another hand, the use of phase change materials is promising for the solar thermal energy conversion systems due to their thermal accumulation properties. The main aim of the project is to develop of physical insight and to find the optimal configuration of the nanostructured silicon based solar cells system for efficient cooling of active photovoltaic elements and for further reutilization of the thermal energy excess.

**3. The objectives of the project**

* Characterization of the composite system: porous silicon/silicon nanowires arrays filled by phase change material (hexadecane, paraphines);
* With the use of molecular simulation approach to find physical insight regarding thermal transport across nanostructured solid interface with liquid.
* To establish physical tendencies and mechanism of the thermal response from the nanostructured silicon/liquid interface excited by electro-magnetic radiation
* To develop and fabricate the prototype of the solar cells, to perform their characterization for the cases of solar and for the low intensity (room) illumination. To develop recommendations for practical use of the systems