Organic photovoltaics is an area of science which development is one of the priorities of our civilization. It is related to the growing demand for energy from renewable sources. Scientists pursuing to develop organic photovoltaic technologies focused on the optimization of photovoltaic processes, new materials and their processing. This requires many basic research. Research and objectives of the project fits into this trend.

Operation of the solar cells is based on the photovoltaic effect. Under the irradiation of sunlight exciton is formed in the absorbing semiconductor material. An exciton is an electron and an electron hole pair attracted to each other by the electrostatic force. Exciton moves to the interface of two semiconductors called heterojunction. p-Type semiconductor conduct electron holes, and the n type semiconductor conduct electrons. At the heterojunction the separation of exciton occurs. Then, the charges move to opposite electrodes. This desirable process is accompanied by numerous side processes. Side processes cause deterioration of the properties of solar cells. Limitation of side processes and simultaneous increase of desire processes is one of the major research trends involving the improvement of organic photovoltaic efficiency.

In the typical solar cell the bulk heterojunction is sandwiched between two electrodes. Organic heterojunction require p- and n-type semiconductor. The initial solar cells were based on a dual-layer architecture. The need to increase the junction surface has led to the most commonly used bulk heterojunctions. In the typical organic BHJ p-type semiconductor serves as the main solar light absorber and as the hole transporting phase, whereas the n-type semiconductor transports electrons. Ideal materials for the organic photovoltaic should have a number of respective properties. Currently, the most common photovoltaic cells based on fullerenes as electron acceptors. This is due to the unique properties of fullerenes. Problems resulting from their use increases despite their advantages. In recent years several research groups have begun investigating solar cells based on non-fullerene bulk heterojunctions. Recent results indicate breakthrough in the matter of non-fullerene BHJ OPVs, with the highest reported power conversion efficiency of 8.4%.

The main problems faced by the photovoltaics based on non-fullerene acceptors are limited exciton separation to free charge carriers, low electrons mobility and recombination of the charge carriers. Project attempt to solve those problems

The project addresses the subject of basic research aimed at the determination of the impact of the structure on the processes taking place in non-fullerene heterojunctions and linking them with photovoltaic properties. We propose a new concept of macromolecules with conjugated donor-acceptor main chain D-π-A_1 connected through flexible linker with non-fullerene acceptor A_2 . This concept is an attempt to solve the main issues of non-fullerene organic photovoltaics based on bulk heterojunction. The main issues that are addressed in the project:

- Improvement of exciton separation to free charge carriers
- Improvement of electron transport in BHJ OPV

We strongly believe that the use of acceptor molecule connected to the main donor-acceptor main chain can bring breakthrough in the field of photovoltaic based on non-fullerene BHJ. The use of linkage between these two blocks ensure simultaneous efficient charge separation and high electron mobility.