DESCRIPTION FOR THE GENERAL PUBLIC

The research planned in this proposal is aimed at getting the information on the elementary processes of charge transfer that contribute to charge separation in new generation of solar cells based on organometal-halide perovskite (PSC). These devices burst into the photovoltaic competition only 5 years ago and already have beaten other emerging photovoltaic systems, reaching the power conversion efficiency of over 20%. Two reasons justify the proposed project: the novelty of perovskite materials and their potential practical use in the photovoltaics and other sunlight conversion applications. So far, commercial photovoltaic market has been dominated by crystalline silicon and thin film solar cells. However, the cost of both technologies is still too high for a widespread use of photovoltaics. The main advantage of perovskite solar cells over crystalline inorganic semiconductor technologies is much cheaper production. According to many experts, perovskite solar cells is currently the most promising technology offering potential of both very cheap and very efficient devices. Despite the rapid progress in organic–inorganic perovskite solar cells and device development, the knowledge of fundamental photophysical processes driving the high performance of these devices is still far from complete. Much effort has been paid to optimization of perovskite solar cells efficiency without understanding the physical consequences of the modifications made. Therefore, this proposal is aimed at detailed basic studies of charge transfer processes taking place at the interface of perovskites with contact materials. As for all photovoltaic devices, the operation of solar cell is based on the separation of positive and negative charges generated in the photoactive material after photon absorption towards two electrodes through transporter materials. Charge transfer in crystal may be retarded due to imperfection in the structure. To eliminate this input synthesis process is modified to obtain more efficient solar cells. Therefore, the purpose of the project is to study ultrafast processes taking place in perovskite material after photon absorption depending on synthesis method. Moreover, we plan to study charge transport process toward appropriate electrodes. The expected success of the project is based on a combination of modern tools at the Faculty of Physics (ultrafast and fast laser spectroscopies, electrochemical impedance spectroscopy) at Adam Mickiewicz University in Poznań, the experience of supervisor and principal investigator in the studies of photovoltaic devices by these time-resolved methods, and collaboration with external groups having experience in the preparation of perovskite materials.