Electronics based on organic materials is currently one of the most dynamically developing fields of science and technology. Among optoelectronic devices, organic light emitting diodes due to their properties such as high colour rendering, self-luminescence, high flexibility, and comparatively low power consumption, became very popular element in the next-generation displays and lighting sources.

The principle of operation of light emitting diodes is based on the generation of excitons which are created when electron and hole meet each other in the active layer placed between electrodes. The 25% of all excitons created in this way are singlets and 75% are triplets. Unfortunately the electrically generated triplet excitons are non-emissive states. Thus, in order to achieve highly performing OLEDs triplet excitons should be manipulated toward radiative recombination. To achieve this goal several approaches have been investigated. One of them is application of phosphorescent organo-transition metal compounds. Nevertheless, some of emissive organic complexes comprise of noble metals, such as Ir and Pt, which due to the limited global resources are high-priced. This leads to higher cost of production of phosphorescent OLEDs. Another way to achieve high efficiency devices is the design of materials exhibiting phenomenon called thermally activated delayed fluorescence (TADF). Typically such TADF materials contain donor and acceptor part in the molecule which are chemically bonded and can form a charge transfer (CT) excited state complex. Such complexes could be also called exciplexes, characterized as bimolecular complexes comprising of electron-donor and electron-accepting material, which emission occurs as a result of electron transition from the LUMO of an accepter to the HOMO of a donor. The utilization these CT complexes are promising as they afford to achieve internal quantum efficiency up to 100% excluding heavy metal-containing organometallic complexes. Despite of advantages coming from TADF molecules and exciplexes, they are showing low stability and life time in OLEDs. To solve this problem important is to understand the nature of CT complexes in the electrical field in the conditions close to the environment of working OLEDs. Proposed research can provide knowledge about the mechanisms of processes responsible for efficient electroluminescence in CT molecules, mainly the mechanism of charge carriers transport. A balanced hole and electron transport which depends on the mobility of charge carriers and the trapping process, is crucial for achievement of high device performance.

The project's results might contribute to significant improvement of OLEDs processing and technology.