New compounds containing imide rings and/or imine bonds: synthesis and study of selected physical properties.

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Organic materials exhibiting semiconductor properties attracts particular interest in the last decades due to the possibility of utilizing them in (opto)electronics. The most often investigated typical π-conjugated compounds frequently suffer from insufficient thermal stability and photo stability. Therefore, the search for new, well-defined materials, especially with high threshold for thermal and optical degradation and good processability is still justified. Taking into account the material requirements as an object of our research we selected compounds containing imide rings and/or imine linkages. Such compounds have a special place in the world of science and technology for decades and they seem to be excellent candidates for (opto)electronics due to their unique properties. The most important of these include, among others: both high glass transition temperatures and thermal stability, significant tolerance to chemicals and radiation, good mechanical, thermomechanical and adhesive properties. It should be emphasized that aromatic imide rings, with electron deficient cores, have demonstrated a great potential as n-type semiconductors. Surprisingly much less attention has been paid compared to the p-type organic semiconductors. In contrast to the p-type organic semiconductors, of which a huge amount is described and analyzed, the compounds having electron conductivity are less common. Introduction of imide rings acting as electron acceptors and a suitable electron donor moiety yields a donor-acceptor system, having wide applications in optoelectronics. Taking into account the properties of the compounds with imide groups and/or imine bond, this type of compounds, which contain imide rings and/or imine bond have been selected as the target of this doctoral dissertation.

The objective of thesis was to obtain new, processable, low molecular weight materials and polymers as well as to explore the relationship between their chemical structure and selected physical properties, such as: solubility, thermal properties, optical, electrochemical and electrical properties. The subject of this study was synthesis of new organic compounds containing imide units and/or imine linkages with a carefully designed chemical structure, in terms of modifying the physical properties, which could be used as the active layers in organic light emitting diodes (OLED) or solar cells (OS). In order to modify the properties of the new materials, molecular engineering will be applied to modification of the chemical structure of the starting materials: (di)amine, (di)anhydride and (di)aldehydes. The modifications should allow the preparation of materials with balanced properties that is exhibiting certain optoelectronic properties without compromising processability and thermal stability.