SYNTHESIS AND INVESTIGATION OF ELECTRON TRANSPORTING ORGANIC SEMICONDUCTORS CONTAINING ANCHORING FRAGMENTS

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In the last few decades, rapid increase in energy consumption contributes to the climate change. Limited reserves of fossil fuels are demanding more research on sustainable and renewable energy sources. Solar photovoltaic technologies are considered as clean source of energy, as they replenish themselves naturally without additional depletion of earth resources. Increased usage of solar energy could provide opportunity for mitigation of greenhouse gas emissions and reducing global warming [1].

Perovskite solar cells (PSCs) are considered as potential candidates for next-generation energy harvesting devices, due to their low cost, simple fabrication process and high power conversion efficiency. PSCs consist of active perovskite layer which is sandwiched between hole-transporting layer (HTL) and electron-transporting layer (ETL). The basic functions of the transporting layers are to lower bandgap differences between each semiconductor and perovskite layers, to extract photo-generated charges from the perovskite and prevent their recombination. Yet, the most challenging issue in PSCs is the long-term stability. For example, dopants, such as LiTFSI and *tert*-butylpyridine (t-BP), are significant additives, used to increase conductivity of HTMs and power conversion efficiency of PSCs. However, due to the hygroscopic nature of LiTFSI and relatively low boiling point of t-BP, aswell as possible formation of pyridinated derivatives, both mentioned dopants accelerate the degradation of whole device in general and perovskite light absorber in particular [2,3].

The widely used electron transporting layer in inverted perovskite solar cells are fullerenes and their modified soluble derivatives (e.g. PCBM). Unfortunately, these compounds show some disadvantages such as low solubility of non-modified fullerenes, which limits their application, meanwhile modified fullerenes are relatively expensive [4].

In the past few years scientists were searching for new non-fullerene semiconductors, which could replace fullerene derivatives and improve stability of the perovskite. Naphthalene diimide based electron transporting materials have received a lot of attention due to the simple „one-pot" synthesis, solubility in different organic solvents, good thermal stability, high electron mobility and possibility to be used as self-assembled monolayer compounds by attaching corresponding anchoring functional groups [5,6].

In this work new 1,4,5,8-naphthalenetetracarboxylic diimide semiconductors containing anchoring groups were synthesized. These fragments were used in order to form monolayer of synthesized compounds on top of the perovskite surface.

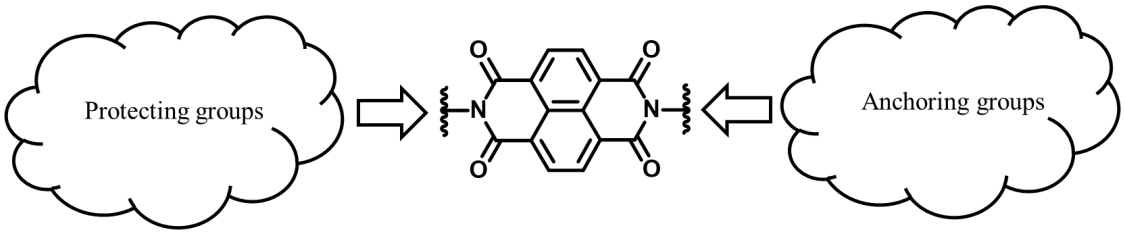

Fig. 1. General structure of synthesized compounds

Studies have revealed that these compounds can be applied as electron transporting materials in the PSCs with inverted architecture. From the obtained results it was determined that anchoring groups can form bonds with the surface of perovskite. Preliminary investigation of synthesized electron transporting materials have shown beneficial optical and thermal properties as well as ability to reduce degradation of perovskite.

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