SYNTHESIS AND INVESTIGATION OF ORGANOMETALLIC PRECURSORS USED FOR COPPER THIOCYANATE LAYER FORMATION

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Growing population is always linked to the increases in energy demands. Fossil fuels – the main source of energy is rather limited, therefore more and more attention is paid to the renewable energy sources. Among them, photovoltaics can be considered as one of the most promising renewable energy technologies to be developed [1]. Up to now, silicon-based solar cells (Si-SC) are dominating the photovoltaic devices industry, well-known manufacturing processes, reliable efficiencies, long-term stability can be named as the main reasons [2]. However, Si-SC production costs are still relatively high, therefore these devices cannot fully compete and replace fossil fuels [3].

Perovskite solar cells (PSCs) can be considered as a possible future competitor for Si-SC. The crucial component of PSC – perovskite offers a lot of benefits, such as: variety of perovskite coating methods, light absorption in a wide spectrum, good conductivity and tolerance to defects [1]. Efficient PSCs usually contain additional charge transporting semiconductors of which hole transporting materials (HTMs) play important role both to the power conversion efficiency (PCE) and the stability of perovskite. Yet, the most popular HTMs are organic small molecules and polymers, which are often relatively expensive and require to be doped to increase their conductivity. As a consequence, presence of dopants decreases the stability of PSCs, which is one of the largest barriers towards PSC commercialization [4].

Inorganic HTMs can be promising candidates to replace organic analogues, since their conductivity is usually significantly higher, therefore they don't need to be doped. Most of them do not absorb light in the visible and infrared regions, therefore the absorption of inorganic HTMs do not interfere or overlap with the perovskite absorption. Additionally, inorganic semiconductors are considerably less expensive, which is important for the solar cells manufacturers. So far, NiO_x, CuSCN, CuO_x, V_2O_5, CuS and MoO_2 were investigated as *p*-type inorganic semiconductors for application in PSCs. Among them, one of the best efficiency results have been achieved using CuSCN, reaching 20.4%. However, CuSCN can be only dissolved in ammonia solution and diethyl sulfide (DES); both solvents affect perovskite negatively and induce degradation by damaging or dissolving its structure components [5].

In this work a series of organometallic complexes were synthesized as precursors of CuSCN. All synthesized precursors were obtained in one-step synthesis, purified by quick and inexpensive methods and shown relatively low thermal decomposition temperatures. The best solubility in different organic solvents was demonstrated by CuSCN complexes containing aliphatic amines and 4-(5-nonyl)-pyridine ligands.

The solutions of different precursors were deposited on the glass surface via spin-coating. Subsequently, the formed layers were heated above the relevant organometallic compound decomposition temperature, initiating organic part evaporation and the layer of CuSCN was obtained.

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