NEW FLUORENE DERIVATIVES AS POSITIVE CHARGE CARRIERS FOR EFFICIENT PEROVSKITE SOLAR CELLS

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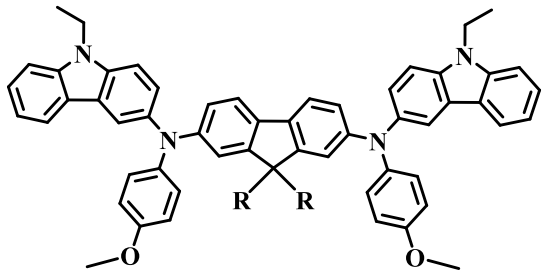
Solar energy is the most powerful source of renewable energy. Properly refined solar cell technology can fully meet society's energy needs. Currently, silicon solar elements are mainly used, but they are expensive and complicated to manufacture. However, in the last decade organic and hybrid solar cells are gaining ground. Among them are the perovskite solar cells (PSCs), which have already reached 24% efficient [1]. The benefits of these elements are cheap starting materials and a variety of different fabrication methods that could simplify industrial applications. However, there are still several drawbacks of PSCs. First is the high cost of the widely used hole transporting material spiro-OMETAD [2], and secondly the unresolved stability problem of these devices. There is a vigorous search for simpler and cheaper methods for the synthesis of organic semiconductors. The aim of this work was to synthesize new p-type organic semiconductors containing carbazolyl-and fluorenylchromophores for efficient perovskite solar cells and estimate the influence of the length of alkyl chains on the properties of new compounds.



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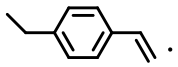
2 $-CH_2CH_2CH_3$;
3 $-CH_2CH2(CHCH_3)CH_2(CH_2)_2CH_3$;
4  .

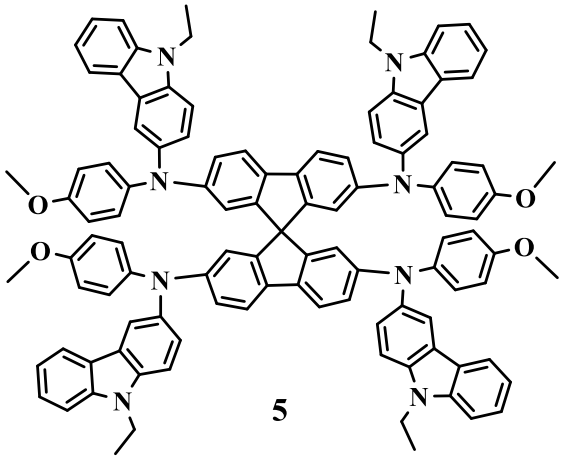


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Fig. 1. Structures of new fluorene-based derivatives.

During this work, new fluorene class compounds (**1**-**5**) were obtained in three-step reaction. From investigated optical properties, it is evident that all compounds have two maximum absorption peaks between 303 and 377 nm. All target substances are amorphous and have thermal stability greater than 400 °C. It has been observed that longer alkyl chains reduce the thermal stability and glass transition temperature. Ionization potential (3,77-5,28 eV) and hole drift mobility ($3{,}25 \cdot 10^{-5} - 3 \cdot 10^{-3}$ $cm^2/V{\cdot}s$) of new compounds are favorable for the use in PSCs as hole transporting materials. However, the obtained data show that the increase in the length of alkyl chains tend to rise the numeric value of ionization potential and decrease the charge carrier mobility.

[1] Q. Jiang, Y. Zhao et al. Surface passivation of perovskite film for efficient solar cells, Nat. Photonics **13,** 460–466 (2019).
[2] T. P. I. Saragi, T.Spehr et al. Spiro Compounds for Organic Optoelectronics, Chem. Rev. 107, 1011-1065 (2007).