Ambipolar transport in thin layers of new π-conjugated imidazole/carbazole compounds

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Aryl-substituted imidazoles are of perspective photo- and electroactive compounds[1], so push-pull aryl/heteroaryl π-conjugated molecules based on combination of imidazole rings and carbazole or 3,3'-bicarbazole systems (Figure 1) are expected to possess ambipolar carrier transport.

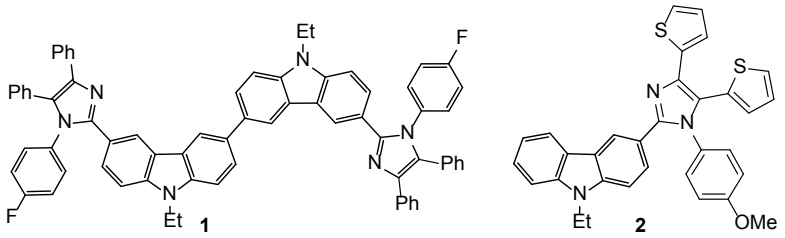

Fig.1. The structure of investigated organic semiconductors **1** and **2**.

In this work, charge carrier mobility in **1** and **2** thermal vacuum-deposited layers was measured by the MIS-CELIV (metal-insulator-semiconductor - charge extraction by linearly increasing voltage) method[2]. Such layers were uniform compared to drop cast layers. In 1, the mobility values were equal to $5.5 \cdot 10^{-5}$ $cm^2V^{-1}s^{-1}$ and $4.5 \cdot 10^{-6}$ $cm^2V^{-1}s^{-1}$ for electrons and holes, respectively, and in 2, they were equal to $3.4 \cdot 10^{-4}$ $cm^2V^{-1}s^{-1}$ and $6.2 \cdot 10^{-5}$ $cm^2V^{-1}s^{-1}$, correspondingly.

In the both materials, the mobility of electrons exceeds that of holes. The difference in electron and hole mobility can originate from the arrangement of the molecules in the solid layers which favors for hopping rather electrons over LUMO levels distributed within imidazole moieties than holes over HOMO levels distributed within carbazole systems. The reasons for the better packaging of molecules is thought to originate from the structure of their side chains, the spreader π-conjugation system and small size of the molecules **2** compared to molecules **1**.

For the both organic semiconductores, the method of preparation of a thin layer was found to strongly affect the charge carrier mobility: the mobility in layers prepared from a solution was much lower than that in vacuum-deposited layers[3].

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