Methoxy-substituted naphthothiophenes – single molecules' vs. condensed phase properties and prospects for organic electronics applications

Anatoly Botezatu[1*], Andrey Khoroshutin[2],Sergey Tokarev[1], Dmitry A. Lypenko[3], Alexey Tameev[3], Olga Fedorova[1]

[1]INEOS RAS, Russia, Moscow, Vavilova St. 28

[2]Lomonosov Moscow State University, Faculty of Chemistry, Russia, Moscow, 1-3 Leninskiye Gory

[3]A.N. Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Russia, Moscow, Leninsky Prosp. 31, bld.4.

*E-mail: tolik.botezatu98@gmail.com

In this work, a series of tricyclic naphthothiophenes – photocyclization products (8-methoxynaphtho[1,2-b]thiophene (**1a**); 6,7-dimethoxynaphtho[1,2-b]thiophene (**1b**); 8-methoxynaphtho[2,1-b]thiophene (**2a**) have been studied. All compounds possessing similar structures demonstrated the close optical, electrochemical characteristics. Spectroelectrochemical investigation showed that **1b** and **2a** are able to form stable radical particles at 1.55 V. In case of **1a**, the formed at 1.55 V radical is short-living.

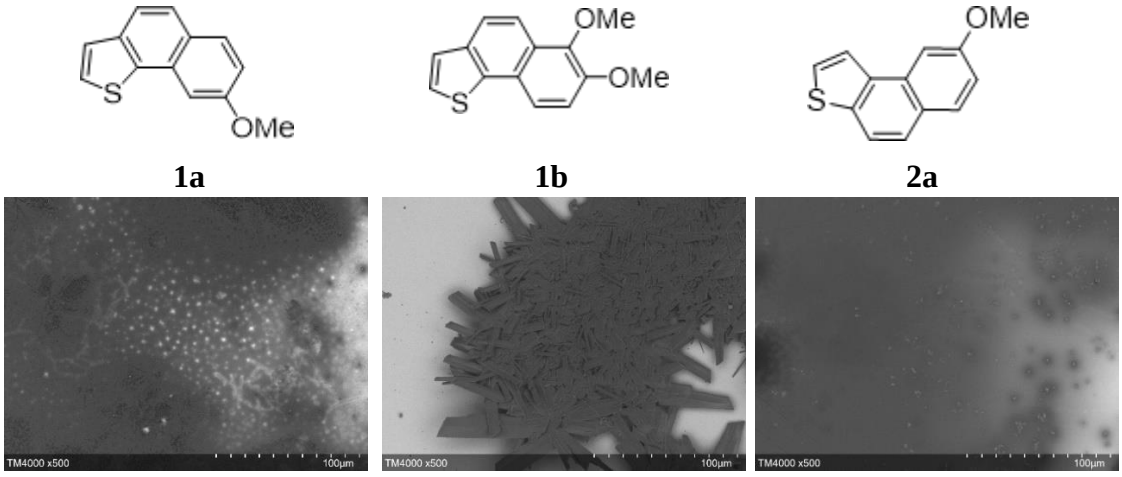

Fig.1 SEM image of **1a, 1b, 2a** film (thickness – 200 nm).

We have demonstrated, that due to differences in the morphology thin films of **1a** and **2a** exhibit the charge carriers mobilities (10^{-4} $cm^2V^{-1}s^{-1}$) one order of magnitude higher than that of **1b**. The **1a** and **2a** layers predominantly consist of an amorphous phase incorporated with microcrystals (Fig. 1). On the contrary, 1b layers are formed only by microcrystals. Poor contacts between individual microcrystals limit the transport of charge carriers in such a polycrystalline medium. At the same time, the charge carrier mobility of **1a** in crystal form is reaches high values (0.09 $cm^2V^{-1}s^{-1}$). This indicates that these substances may serve a good starting point for the search for a new prospective organic semiconductors.

Acknowledgements. The reported study was funded by RSF according to the research project № 17-73-30036