Electronic supplementary materials *Mendeleev Commun.*, 2021, **31**, 641–643

New n-type semiconductor material based on styryl fullerene for organic field-effect transistors

**Airat R. Tuktarov, Nuri M. Chobanov, Zarema R. Sadretdinova, Renat B. Salikhov,
Ilnur N. Mullagaliev, Timur R. Salikhov and Usein M. Dzhemilev**

Experimental section. Commercially available [60]fullerene (99.5% pure, Sigma-Aldrich) and PCBM (>99.5 % pure, Sigma-Aldrich) were used. Substrates with a conductive ITO film (indium tin oxide) had a surface resistance of 8-12 Ω/sq. The synthesis of styryl fullerene (>99 % pure) was carried out according to the method described in the literature.[S1]

Glass with an ITO film was used as substrates for field effect transistors. The ITO film in our case is a gate contact. Before the formation of dielectric films, the substrates were annealed in an oven at 350 °C. AlOx films with a thickness of 400 nm were created as a dielectric. AlOx films were created by the wet method, centrifugation from solution.[S2] Two layers of 1x concentration, at 2000 rpm for 30 seconds, and annealing in an oven for 2 hours at 350 °C each layer. Two layers of 5x concentration, at 3000 rpm for 30 sec, and annealing in an oven for 2 hours at 350 °C each layer. Then, two aluminum electrodes (a source and a drain) with a thickness of 500 nm, were deposited on the top using the VUP-5 vacuum universal post by thermal evaporation in vacuum (2×10^{-5} mbar). The gap between the contacts is 50 μm and their length is 4 mm.

One group of field effect transistor samples was made with thin films of fullerenes, which were thermally evaporated in vacuum from a Knudsen cell. Knudsen cell parameters: the length of the cylindrical chamber is 25 mm, the inner diameter is 4 mm, and the operating temperature varied in the range 240-280 °C. Another group of transistors consists of fullerene or its derivatives thin films, which were created by spin-coating from a solution. Fullerenes were dissolved in toluene, the resulting concentration was 1 g/L. The spin-coating parameters: 800 rpm, rotation time 1 minute. Residues of the solvent were removed by heating in an oven at 40°C for 1 hour. Manufacturing and testing of OFET devices took place in an ordinary atmosphere with a relative humidity of 20%.

References.

[S1] A. R. Tuktarov, N. M. Chobanov, Yu. H. Budnikova, Yu. B. Dudkina, U. M. Dzhemilev, *J. Org. Chem.*, 2019, **84**, 16333.

[S2] S. H. Kim, S. H. Lee, Y. G. Kim, J. Jang, *IEEE Electron Device Lett.*, 2013, **34**, 307.

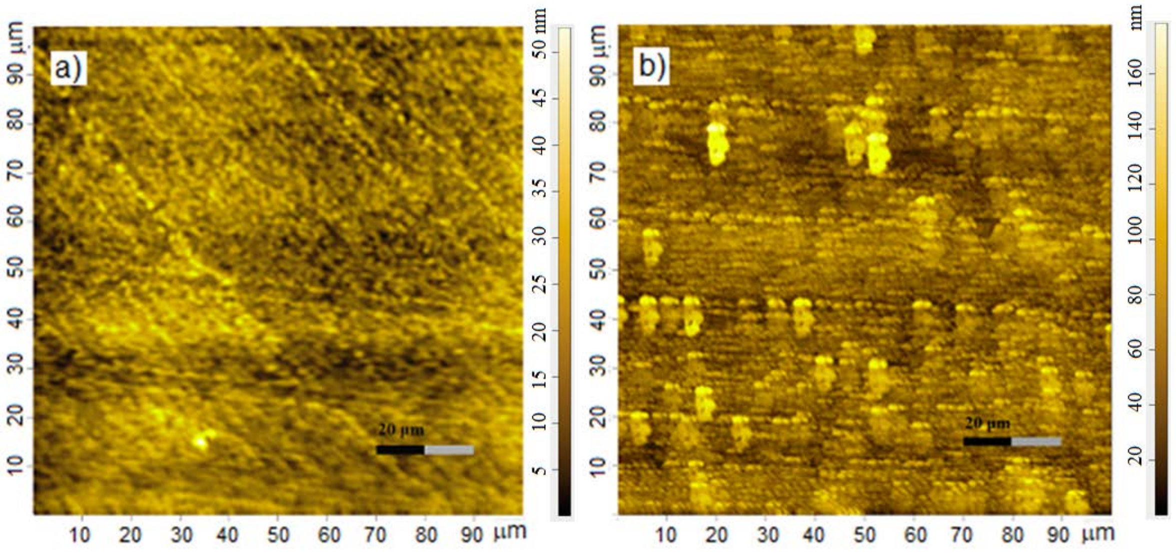

Figure S1. Image of the surface of the films prepared by vacuum deposition of PCBM (*a*) and styryl fullerene (*b*) on a glass surface. The film thickness made ~ 150 nm.

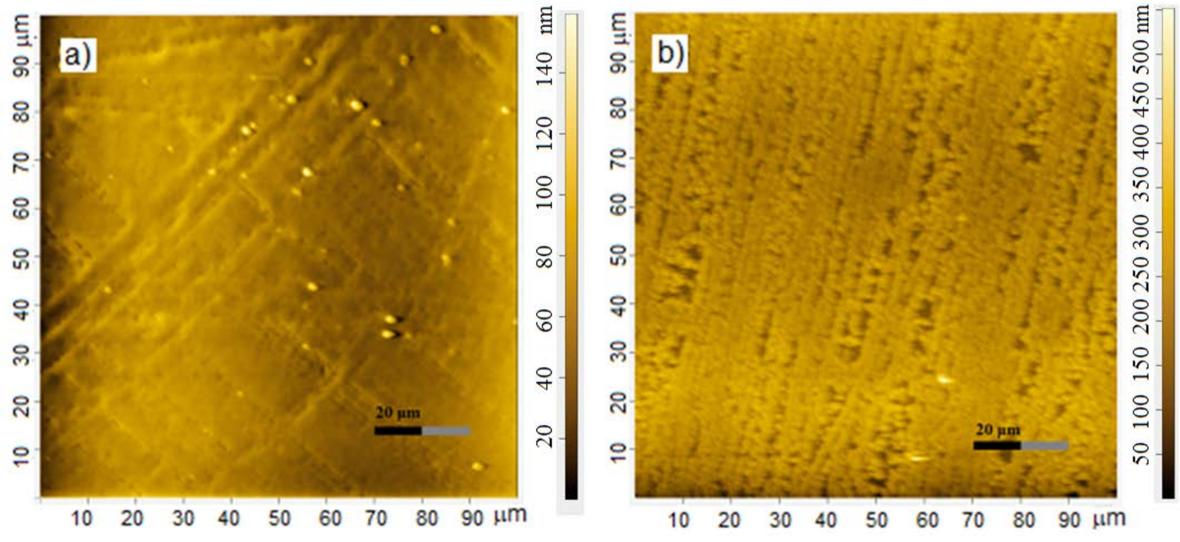

Figure S2. Image of the surface of the film on the basis of PCBM (*a*) and styryl fullerene (*b*) obtained by the wet method. The film thickness made ~ 150 nm.

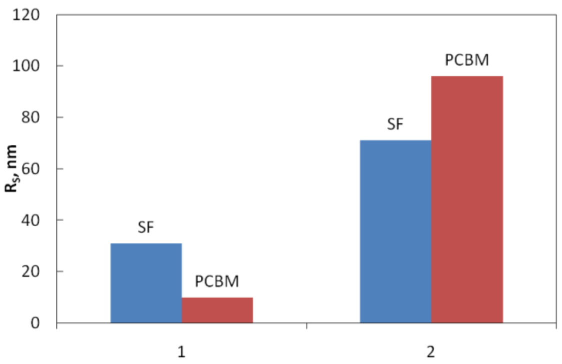

Figure S3. The influence of the method for producing PCBM and styryl fullerene films on root mean square roughness (1) films prepared by the dry method, (2) films prepared by the wet method.