Vacuum-deposited organic thin-film transistors based on dinaphthotetrathienoacenes

Federico Modesti[1], T. Musiol[1], R. Jouclas[2], M. Volpi[2], G. Schweicher[2], Y. Geerts[2,3], P. Erk[1]

[1] BASF SE, RCS - J542S, 67056 Ludwigshafen am Rhein, Germany
[2]Laboratoire de Chimie des Polymères, Faculté des Sciences, Université Libre de Bruxelles (ULB), Boulevard du Triomphe, CP 206/01, 1050 Bruxelles, Belgium
[3] International Solvay Institutes for Physics and Chemistry, Université Libre de Bruxelles (ULB), Boulevard du Triomphe, CP 231, 1050 Bruxelles, Belgium

Organic thin thin-film transistors (TFTs) were fabricated through vacuum sublimation using two large thienoacenes molecules: naphtho[2,3-b]thieno-[2'',3'':4'',5'']thieno[2'',3'':4',5']thieno[3',2'-b] naphtho[2,3-b]thiophene (DN4T) and naphtho[1,2-b]thieno[2'',3'':4'',5'']thieno[2'',3'':4',5']thieno[3',2'-b]naphtho[1,2-b]thiophene (iso-DN4T). The structures-properties relationships of the two molecules are investigated using atomic force microscopy, grazing incidence X-ray diffraction along with charge-transport measurements, providing a detailed comparison of the semiconductor thin-film morphology, crystallinity and electrical performances as a function of the substrate temperature. DN4T TFTs exhibit high charge carrier mobility compared to isoDN4T devices which gave rather poor performances, confirming the predicted structure-properties relationship. The study contributes to a wider understanding of the relationship between the molecular structure and the charge transport with respect to the thin-film's crystal packing of large thienoacenes.

Acknowledgement

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 811284