Annotations of Doctoral Thesis Topics for Degree Programme

‘‘Nanotechnology and Advanced Materials’’

Topic: Dielectric spectroscopy of memristive polymers

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Annotation:

The dissertation will focus on the study of polymers with carbazole groups, which act as electrical functional units with variable conformation, determining their charge transport capability. The functional electronic components will be examined using dielectric spectroscopy to determine their properties (complex permittivity, loss tangent, AC conductivity) as a function of temperature, leading to the identification of relaxation processes (transitions of the main and side chains). Additionally, the method of thermally stimulated current (TSC) measurements will be utilized to achieve an equilibrium polarization state, followed by measuring the depolarization current and performing the deconvolution of overlapping relaxation phenomena. The method of thermally stimulated luminescence and the analysis of electrical conductivity will reveal the structural parameters necessary for the development of memristive polymers exhibiting desired switching properties. Furthermore, these (co)polymers can be "doped" with a third chromophoric comonomer, which may provide the system with an optical reset and/or modify charge transport and switching characteristics.

Requirements:

Knowledge of general and macromolecular chemistry and physics at the university level. Good knowledge of the English language or a potential to the improvement. Basic manual and laboratory work skills. Ability to work independently.

Literature:

1. Terje A. Skotheim, John Reynolds: *Conjugated Polymers Theory, Synthesis, Properties, and Characterization*, Book, 3rd Edition, First Published 2006, Imprint CRC Press. DOI: https://doi.org/10.1201/9781420043594
2. Grant Benjamin; Bandera Yuriy; Foulger, Stephen H.; Vilčáková, Jarmila; Sáha, Petr; Pfleger Jiří: Boolean and elementary algebra with a roll-to-roll printed electrochemical memristor, *Advanced Materials Technologies*, 2022, 7, Article Number2101108, DOI:10.1002/admt.202101108
3. Foulger, Stephen H.*; Bandera, Yuriy; Benjamin Grant; Vilčáková, Jarmila; Sáha, Petr: Exploiting multiple percolation in two-terminal memristor to achieve a multitude of resistive. *Journal of Materials Chemistry C*, 2021, vol. 9, pp.8975-8986, DOI:10.1039/d1tc00987g4. Memristors for Neuromorphic Circuits and Artificial Intelligence Applications, ISBN 978-3-03928-577-8, 2022, Publisher: Springer, https://www.mdpi.com/journal/materials