20th International Conference on
Emerging Materials and Nanotechnology
June 25-26, 2018 | Vancouver, Canada

High energy density materials for capacitive energy storage

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Rapidly growing energy production motivates the development of efficient and safe energy storage. Dielectric materials that we develop demonstrate high polarizability and sufficient resistivity to be candidates for massive inexpensive energy storage. We suggest the use of these dielectric materials as films in the new type of capacitors that would have higher energy density as compared to traditional capacitors. In general, dielectric films in the proposed capacitors should be polarizable, and maintain the polarization energy without breakdown. Hence, film forming species should contain at least two parts, the inner being responsible for the polarization, and the peripheral one having required resistance. Aromatic rings connected by diazo bridges are of great interest for us since similar linkers have been justified for many decades in azo dyes. The potent material that we develop comprises -N=N-(p-C_6H_4)- subsequently conjugated units, along with electron acceptor group (NO_2) on one side and electron donor -N(*n*-$C_{10}H_{21}$)$_2$ group bearing resistive tails on the other side. Analysis of the crystal structure of the material reveals a head-to-tail arrangement of molecules, forming alternating layers of conjugated cores and resistive tails. Layers formed by tails are responsible for the high resistivity of our material. Corona experiments as well as *in-situ* Raman spectroscopy demonstrate nonlinear dielectric behaviour of the materials. This behaviour confirms that application of electric field leads to the increase of the polarization. Energy density of our material is estimated to be up to 2 kWh/kg.

Biography

Andrey Borzenko has completed his PhD at the age of 29 years from University of British Colmbia and postdoctoral studies from Dalhouse University. He has published more than 10 papers in reputed journals.

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