



International Nanotechnology Conference & Expo

April 4-6, 2016 Baltimore, USA

Metadielectric capacitors for energy storage

Pavel Lazarev*¹ and Lev Mourokh^{2,3}

¹Capacitor Sciences Inc., USA

²Department of Physics, Queens College of CUNY, USA

³The Graduate Center of CUNY, USA

Efficient energy storage is the key component in the development of various modern technologies. In the present time, the all-electric cars start to enter the vehicle market but they are still more expensive and less trustworthy than the usual ones. Electronic devices, which are omnipresent in modern society, are also heavily dependent on reliable energy storage modules. Moreover, renewable energy sources such as solar cells and wind turbines are sustainable and environmentally friendly, but their energy production is intermittent and the effective storage would make the energy available on demand. Available market for energy storage devices is expected to exceed \$1000B. As the limitations of the electrochemical batteries are impossible to overcome, the right answer should arrive from the capacitor side. In the present time capacitors are cheap and have very high power density. To make them competitive with the batteries, their energy density should be increased.

The energy density stored in the capacitor is proportional to the applied voltage squared with the proportionality coefficient determined by the permittivity of the material inside the capacitor. Correspondingly, large values of the energy density can be achieved by using composite polymer materials with the permittivity increasing with the voltage. This can be especially efficient at high operational voltages. In this talk we discuss an approach to use a specific class of polymers to develop capacitors having extremely high energy density. These polymers display interesting polarization dependencies on the electric field. It is possible to perform crafty molecular engineering to achieve necessary phenomenology. We believe that the proposed approach ushers a new generation of the energy storage devices providing the solutions to the many needs of the society.

Biography:

Pavel Lazarev is the inventor of Capacitor Sciences' high permittivity technology and founder of the Company. He also is the founder of Cryscade and inventor of the company's Donor-Bridge-Acceptor technology. He received his Masters from Moscow State University, Ph.D. in Crystallography and Dr. of Science Degree in Biophysics from the Russian Academy of Science. Previously, Pavel founded Nanotechnology MDT (www.nt-mdt.com), Akvion (www.akvion.ru), Optiva Inc., Ribtan Inc. (www.ribtan.com) and Crysoptix KK, (www.crysoptix.com). Pavel was an editor of International Journals 'Molecular Engineering', 'Nanobiology' and 'Molecular Materials'. Pavel has published several books, over 150 technical publications and over 200 inventions with emphasis on the R&D and production of functional crystalline films based upon coatable lyotropic liquid crystals.