Nanocomposites and nanomaterials

Electroactive polymer composites with 1D structure of conductive phase

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Electroactive polymer materials with conducting properties attract significant academic and industrial interest in recent years. The main factor defining electrical and physical properties of electroactive polymer composites is the features of their specific heterogeneous structure. Magnetic field can be used to regulate the phase morphology of the filler in the nanocomposites, thus determining their properties. It is therefore expected that the composites would exhibit anisotropic electrical properties, in accordance with the parallel and perpendicular direction to the magnetic field that has been applied and under which the one dimensional (1D) alignment has taken place. For example the concept of the orientation of magnetic particles inside polymer matrix can be successfully used for creation of the 1D-composites with high thermal and electrical conductivity at low content of the filler.

Oriented 1D structure of conductive phase is also extremely sensitive to the applied stress and can be used for creation of stress-sensitive polymer materials which are required in many areas of technical applications (for example, smart wear, sensors of acceleration, sensors of pressure, etc.). Such materials change their resistivity under impact of applied stress. It was studied the composites based on silicone polymer and Ni particles with different size aligned in magnetic field. The composites containing combination of Ni powder with carbon fillers were investigated as well. The cyclic stresses were applied to the 1D-composites, the deformation and electrical current were measured along the cycles. The results have shown high electrical sensibility of obtained composites to the applied stress.