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ADVANCED CERAMICS AND APPLICATION II
New Frontiers in Multifunctional Material Science and Processing

Serbian Ceramic Society
Institute of Chemistry Technology and Metallurgy
Institute for Technology of Nuclear and Other Raw Mineral Materials
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Piezoelectric polymer/ceramic nanostructures for mechanical energy harvesting

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Vibration-based mechanical energy is one of the most accessible energy source in the surroundings. Harvesting this type of energy exhibits a great potential for remote/wireless sensing, charging batteries, and powering electronic devices. Piezoelectric and ferroelectric materials, including PZT, $BaTiO_3$, ZnO, polyvinylidene fluoride (PVDF), etc., can be used for converting ambient mechanical energy into electricity. Based on these materials, a variety of micro- or nanoelectromechanical systems can be developed for harvesting energies from random vibrations, mechanical waves, or body movements like walking, running, or typing. Recent investigations on nanocomposites of electroactive ceramics and ferroelectric polymers exploit this approach in order to produce new multifunctional materials for mechanical energy harvesting. Taking into account that mechanical activation is one of the methods for modification of physico-chemical properties of the filler, in this study we investigate the influence of mechanical activation of ZnO particles on structural properties of ZnO/polyvinylidene fluoride nanocomposites. The nanocomposite films were prepared by solution casting method and investigated by X-ray diffraction (XRD) method and Raman spectroscopy, while the microstructure morphology has been analyzed by scanning electron microscope (SEM). Presented results will enable optimization of PVDF processing techniques for the production of new mechanical energy harvesting devices.

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Pulsed Laser Deposition of $BaTiO_3$ on PVDF substrate

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Piezoelectric materials play an important role in development of advanced Micro-electro-mechanical systems (MEMS) and Nano-electro-mechanical systems (NEMS). Their applications span the aero-space industry, communications, defense systems, national security, health care, information technology and environmental monitoring. Materials used in MEMS/NEMS must