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Research of piezopolymer cells from polypropylene and mineral fillers for their application to sensors and harvesting energy**Ewa Klimiec¹, Monika Machnik¹, Grzegorz Kolszczynski¹, Jacek Piekarski¹, Halina Kaczmarek² and Boguslaw Krolikowski³**¹Institute of Electron Technology, Poland²Nicolaus Copernicus University in Torun, Poland³Institute for Engineering of Polymer Materials and Dyes, Poland

The development of low power electronic systems requires searching for the cheap materials for mechanical to electrical energy converters that would be used for power supply. One of such materials are polymer films made of isotactic polypropylene with a high degree of crystallinity that are filled with aluminosilicate mineral or glass beads. These films are characterized by a cellular structure that allows obtaining a permanent electret after the polarization process in an electric field ~ 100 V/ μm at a temperature of ~ 85 °C. The structure of the film was examined using SEM and XRD. A high impact of kaolin on the mechanical strength of the film was observed. The polymer filling the plate structure of the filler affects the good mechanical strength of the film. Young's modulus is above 1000 MPa and is therefore close to or even greater than the value for pure i-PP. Electrets used in transducers must be characterized by a long depolarization time. This is favored by the resistivity of the film, which is 10^{17} Ωm . The durability of the electrets was investigated with aid of TSDC analysis. The temperature T_m exceeds 70 °C and the approximate activation energy is up to 6 eV. The piezoelectric coefficient d_{33} ranges from 200 to 70 pC/N, which indicates the high sensitivity of the film. The film was placed in a shoe insole to determine the amount of harvesting energy during the walk. The maximum power that can be obtained from one film layer was a few to a dozen or so μW .

Biography

Ewa Klimiec has completed her MSc degree in Ceramics Chemistry from AGH University of Science and Technology, Faculty of Materials Science and Ceramics, Krakow, Poland and PhD degree in Electronics from AGH University of Science and Technology, Faculty of Electrical Engineering, Automatics, Computer Science and Electronics, Krakow, Poland. She has worked as a Designer of Resistors in electronic components factory, Telpod, Krakow, Poland from 1973-1976. She has been working at Institute of Electron Technology, Krakow Division, Poland. She is co-author of more than 60 scientific papers. Her research field comprises materials for electronics, suppression resistors, piezopolymer electret transducers, energy harvesters and sensors for medical applications.

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