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Durability of composite polyethylene electrets: A way of calculating the activation energy of depolarization processes

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Most polymers exhibit piezoelectric properties after the polarization process, but only those for which the depolarization process takes at least several years are suitable. There is a need to look for cheap materials, with uncomplicated manufacturing technology, so that they can find wide range of applications as pressure sensors. These include high and medium density polyethylene and its composites with mineral fillers. Composite foils with cellular structure were obtained in the extrusion process. The structure and phase composition of the samples were examined using a scanning microscope and X-Ray diffractometer. In order to obtain electrets, the film was polarized in an electric field with an intensity of 60 to 100 V/μm. The durability of electrets, which is the basic feature taken into account in practical applications was determined in Thermostimulated Discharge Current (TSDC) studies. Activation energy was calculated by using the Arrhenius equation. However, depolarization of electrets often consists of several overlapping processes and a significant error occurs affecting current density values both at the initial rise temperature and around the temperature Tm of maximum depolarization current density. For this purpose, the initial rise method was extended by statistical methods and a correction of the current density curve was introduced in order to calculate more accurately the activation energy. Obtained activation energy ranges from 2 to 4 eV and the value of the piezoelectric coefficient is above 70 pC/N, which confirm that polyethylene is suitable for mechano-electric transducers for general use.

Biography

Grzegorz Kolaszczynski obtained his MSc degree in electrotechnics from Cracow University of Technology, Faculty of Electrical and Computer Engineering, Cracow, Poland in 2006. In the same year he started gaining his expierence at Calibration Specialists Ltd (Ireland) where he was creating manual and automatic calibration systems and procedures. At 2014 he started working at Institute of Electron Technology, Division in Krakow where he working as hardware and software developer for embedded systems. For several years, he has been involved in research in the field of materials engineering, working on activation energy, the durability of electrets and sensors for medical applications.

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