

EXTRUSION OF PIEZOELECTRIC FILAMENTS

R. S. Martins¹, M. P. Silva², J. M. Nóbrega¹, H. Carvalho³, S. Lanceros-Mendez² and J. G. Rocha⁴

¹ IPC/I3N – Institute for Polymers and Composites, University of Minho, Campus de Azurém, 4800-058 Guimarães, Portugal

² Centro/Departamento de Física, Universidade do Minho, Campus de Gualtar, 4710-058 Braga, Portugal

³ Dept. de Engenharia Têxtil, Universidade do Minho, Campus de Azurém, 4800-058 Guimarães, Portugal

⁴ Dept. Eletrónica Industrial, Universidade do Minho, 4800-058 Guimarães, Portugal

The application of electroactive materials in textile products has a huge potential. However, the difficulties related to the integration in textile products of materials that possess those characteristics have limited the development of practical applications that fully exploit their capabilities.

This work describes the development of a technology, which pursues the production of electroactive materials easy to integrate in textile products. For this purpose, multilayer piezoelectric filaments were produced by filament coextrusion. Poly(vinylidene fluoride) (PVDF) was used as the piezoelectric material and an electrical conductive thermoplastic grade, comprising a PP matrix, was used as the electrical conductive inner layer to produce a two-layer filament with coaxial layers. The samples were produced in a monofilament coextrusion line, and were stretched to ratios up to 6 at temperatures of 80°C to 120°C, to obtain the PVDF in β -phase, the most electroactive phase of that material. The filaments were subsequently covered with a conductive ink and the PVDF layer was poled using high voltage applied between the inner conductive layer and the conductive ink. The piezoelectric properties of the produced filaments were evaluated in a test setup, designed to stimulate the filament mechanically by bending it periodically. A charge amplifier was used to condition the output signal. The results obtained confirm the piezoelectric property of the produced coextruded filaments, opening a new field of research and development directed to mechanical sensors/actuators in filament form.