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Direct fabrication of a 3D-shape film of polyvinylidene fluoride (PVDF) in the piezoelectric β -phase for sensor and actuator applications

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Abstract

Until now, getting non-porous pure PVDF in the piezoelectric β -phase involved the application of stresses that limit the production of piezoelectric films into a flat form. In this work we present a new method to obtain, directly from the melt, pure β -PVDF which also allows the production of films with a 3D shape. A hydrophilic ionic liquid (IL), C₂mim BF₄, is used to totally induce the direct crystallization of PVDF in the piezoelectric β -phase during the melt. Afterwards, this IL is completely removed by washing the film in water at 70 °C. The process results in the production of a non-porous pure PVDF film, totally crystallized in the β -phase. Finally and for the first time, the replication of a 3D shape given by a glass form could be demonstrated by using this polymer.

Keywords: Poly(vinylidene fluoride), PVDF, ionic liquid, piezoelectricity, 3D, Three dimensional, electroactive polymers

1. Introduction

Since its discovery in 1880, piezoelectric materials have arisen a huge interest as a result of their capacity to generate an electrical response under a mechanical

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