

Magnetic and dielectric nanoparticle based polymer tri-composites for actuators applications

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Abstract

Smart, stimuli-responsive polymer nanocomposites that result from the combination of two or more fillers allow to combine the excellent properties of each component, allowing to tailor multifunctionality for specific applications [1,2]. In this work, multifunctional tri-composite materials, based on dielectric BaTiO₃ (BT) and magnetic CoFe₂O₄ (CFO) fillers into a polymer matrix of poly(vinylidene-fluoride) (PVDF), have been developed with high dielectric and magnetic properties. The microstructure, polymer phase, thermal, magnetic, dielectric and electrical properties of the composites with different compositions have been investigated. A high dielectric constant of 26 at 1 kHz and a magnetization of 5.7 emu/g are obtained for a sample of 10%BT-10%CFO/PVDF, which was used for the development of a magnetic actuator, allowing magnetic deformation control. The magnetic

actuator displays a rapid response to the application of a magnetic field, allowing active switching control of an electrical circuit.

References

- [1] J Oliveira, V Correia, H Castro, P Martins, S Lanceros-Mendez. Additive Manufacturing, 21 (2018)269
- [2] S Kamila. American Journal of Applied Sciences, 10 (2013) 876

Figures

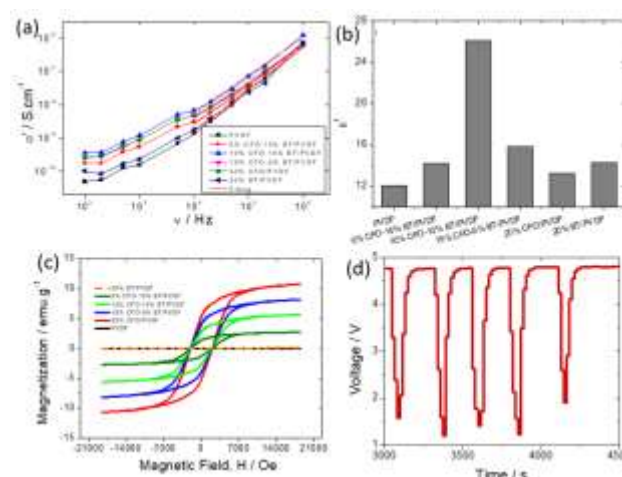


Figure 1: (a) AC electrical conductivity. (b) Dielectric constant at 1 kHz. (c) Magnetic hysteresis loops. (d) Actuator response for 10%BT-10%CFO/PVDF sample.



Figure 2: Schematic representation of the magnetic actuator and the corresponding electronic circuit.