Soft-organic Thin-films, based on Nanostructured Polymeric Composites, as Ultra-sensitive Piezoresistive Sensors for Biomedical Applications

Jaume Veciana,[1,2] Elena Laukhina,[2,1]Raphael Pfattner,[1,2] Lourdes R. Ferreras,[1,2] Marta Mas-Torrent,[1,2] Vladimir Laukhin,[3,1,2] Concepció Rovira,[1,2]

[1]Institut de Ciencia de Materials de Barcelona (CSIC), 08193- Cerdanyola, Spain
[2]CIBER de Bioingeniería, Biomateriales y Nanomedicina 08193-Cerdanyola, Spain
[3]Institució Catalana de Recerca i Estudis Avançats , Barcelona, Spain.
vecianaj@icmab.es

Abstract. The development of intelligent materials that can respond to the application of an external stimulus is of major interest for the fabrication of artificial sensing devices able to sense and transmit information about the physical, chemical and/or biological changes produced in our environment. If these materials can be deposited or integrated on flexible and transparent substrates and processed employing low-cost techniques their appeal is greatly increased. Here, we present soft organic bi-layered thin films [1], composed of a polymeric matrix with a top-layer formed by a nanocrystalline network of a conducting molecular charge-transfer salt. These bilayered thin films are prepared by simple chemical methods that do not require any special conditions and facilities. One of the most surprising properties of such nanostructured thin films is their capacity to translate micron-scale elastic elongations of the film into reversible deformations of the soft organic charge-transfer salt crystals at the nanoscale [2,3]. These multiple length scale movements are responsible of the ultra sensitive piezoresistive properties of the nanostructured thin films that are extremely sensitive to strain changes with durable, fast and completely reversible responses. Such conducting, transparent, and flexible thin films showing a sensitivity one order of magnitude larger than the most commonly used electromechanical sensors have integrated in textiles that exhibit the same ultrasensitive piezoresistive sensitivity [4]. In addition, a few proof-of-concept experiments with simple prototypes for bio-medical applications (see Figures), based on such soft nanocomposite polymeric materials, will be reported [5,6].

References

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Figures. Examples of biomedical prototypes made with the piezoresistive thin film