Development of ultra sensitive strain sensors based on all-organic flexible thin-films using conducting TTF-like salts

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Over the last thirty years tetrathiafulvalene (TTF) and its derivatives have been successfully used as building blocks for charge transfer salts giving rise to a multitude of organic conductors and superconductors. These conductors are obtained as single crystals and, therefore, their applications are limited. However, micro- and nanocrystals of conducting TTF salts structured on the top of polymeric thin-films, named as bilayered (BL) films, offer great potential for applications in electronic devices. These materials are very promising since they combine the unique physical properties of molecular conductors with the processability and flexibility of polymeric films. In addition "all-organic" circuits can be drawn with such BL films by patterning such composite materials with a local thermal treatment.

BL films are also extremely sensitive to strain changes and exhibit fast and completely reversible responses. Such BL films have a sensitivity one order of magnitude larger -gauge factors between 18 and 9- than the most commonly used metal-based electromechanical sensors (Fig. 1). In addition, a few proof-of-concept experiments with simple prototypes will be also reported demonstrating that these flexible, low-weight, and transparent composites are very attractive as a new generation of durable and low-cost all-organic strain sensors being highly promising for a wide range of applications.

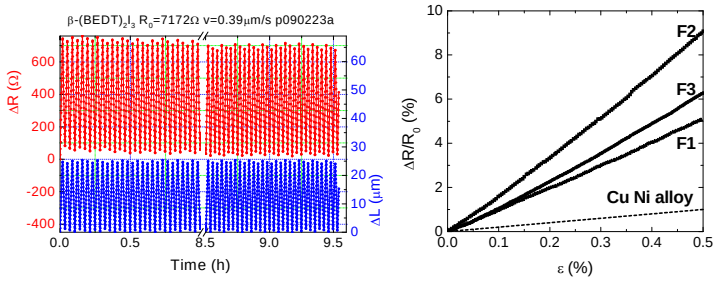

Fig. 1 *Left*: Resistance changes with time for the first and last cycles of 270 cyclic deformations of 24 μm elongations applied to a F2 film. *Right*: Linear dependence of the relative resistance changes with respect to the relative strain applied for three films **F1**, **F2**, and **F3** based in different CT salts. A typical resistance-strain curve for a Cu-Ni alloy is also depicted for comparison purposes