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# POLYMERIC PRESSURE SENSORS: A CONCEPTUAL VIEW

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**Abstract.** *In the first part of this paper, we present a review of the piezoresistive pressure sensors based on polymeric thick films deposited on rigid and flexible diaphragm. The study of the state of the art has shown the performances of this technology, where maximum sensitivity is obtained on thin flexible diaphragm for a gauge factor of about* 10*, in a pressure range of* 0÷5 kPa*. The present challenges come from the high temperature coefficient of the resistance of about* 500 ppm/°C*, and the long temperature drifts of about* (0.5÷2)%*, which may require improved repeatability of fabrication technology and advanced differential signal processing techniques for the market acceptance. In the second part of the paper, we present our novel concepts for the realization of the piezoresistive pressure sensors. The first concept consists in the surface modification of the organic substrate by ion implantation of nitrogen and phosphorus species for creating piezoresistive behavior and high electrical conductivity of organic piezoresistors. The second concept consists in the novel chemical synthesis route of organic thin film by doping the polyaniline with large molecules of p-sulfonated calix[n]arene* (*n* =4, 6, 8)*, sulfonated crown ethers, in the liquid state. Addition of the metal nanoparticles to the previous homogeneous solution can further increase the piezoresistive factor. Other new features of our second concept come from the direct printing from solution of the above piezoresistive organic thin films, as well as metallic films interconnecting the piezoresistors, and finally the monolithic fabrication of the sensor rim and diaphragm by plastic injection molding, where the pressure diaphragm could be as thin as* 75 micrometers*.*

**Keywords:** piezoresistive organic films, polymeric thick film, pressure sensors, metal Nanoparticples, *p*-sulfonated calix[n]arene, sulfonated crown ethers

## 1. Introduction

Pressure monitoring is an important parameter in the control of a large diversity of industrial processes and medical applications. Pressure can be measured by mechanical devices, as well as electro-mechanical and electro-optical instruments. The measurement of the pressure of a fluid by pure mechanical principle is based on the presence of an elastic diaphragm fixed at one end, which is moving its free end as a result of pressure variation, and its position change is indicated by a needle connected to the free end, and which is thus rotating with respect to its zero position (Fig. 1).

This principle is used for the pressure measurement on gas/liquids pipelines, where pressure manometers based on Bourdon tubes are still in place, today.

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