Integration of multifunctional carbon systems in textiles for flexible and wearable sensors

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Recently there is strong interest in lightweight, flexible, and wearable sensors to meet the technological demands of modern society due to the growing impact of airborne pollutants and explosive gases on human health and occupational safety. Integrated sensor devices of this type are a key area that is still significantly underdeveloped. The smart textile market is now strongly growing due to the consumer demand that provides a greater incentive for industrial innovation. Opportunities are being offered by manipulating textile materials down to the nanoscale or incorporating micro-electronic components into smart fabrics. The synergistic approach of nanotechnology and textile engineering provides a new concept of intelligent high-tech fabrics and wearable multifunctional garments.

In our labs nanocarbons have been widely used to impregnate fibers and polyester cotton blended fabrics to obtain materials with electrical conductivity and improved mechanical properties, as well as to assemble strain-sensitive devices or sensing units of innovative platforms able to detect different gases and vapours.

The target of this last issue is that of obtaining wearable solid state sensors, that ensure reduction of size/weight of the device, of power consumption and of manufacturing costs. This research area can take advantage of an effective production chain and of a strong industrialization plan. In this context it was felt worthwhile to submit to the Italian Minister for Economic Development the project, "NanoFab", a collaboration between different enterprises and universities. This recently started project aimed the scaling-up of know-how to the industrial field.

This communication will briefly describe the procedures used for the preparation of flexible and wearable gas sensors prototypes with an overlook of the challenges and the future perspectives concerning this field. In addition, there are shown the results obtained from the development of such concepts.