SENSING by CNT

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We are witnessing nowadays to a worldwide demand for new functional materials and innovative technologies in the field of sensing and detection. In this context the advent of carbon nanotubes (CNT), with their wide range of outstanding chemical physical properties, opened a new scenario. In our labs a research line is addressed to the development of CNT-based systems able to improve the sensitivity, efficiency, economy, miniaturization and environmental sustainability of sensors and detectors. This contribution describes material preparation and functional tests for the settling of various sensing devices that operate by different mechanisms.
A common key point for all the systems is the settling of protocols for the optimization of the active nanomaterials. This task is carried out by the choice of specific synthetic routes for both SWCNT or MWCNT, as well as by a series of chemical and physical treatments.
The main sensing systems presently in the phase of prototyping are:
-resistive sensors
These CNT- based sensing devices rely on resistance change upon exposure to gas-vapours. The sensing platform can be an interdigitated electrode where CNT are ordered by dielectrophoresis but also flexible/wearable devices are produced using natural or artificial fabrics or polymer layers.
-quartz nano-balance
Strategies have been developed to produce a series of nanocomposites with CNT embedded in polymeric matrices as active material
-optical sensors based on SERS
A series of differently organized CNT/Au systems were successfully used for detection of low-level organic solvents and demonstrated advantages for many environmental applications.
-piezoresistive sensors
The devices have been developed with SWCNTs organized in several form such as:
- *Buckypapers:* binder-free nanostructured sheets made of woven SWCNT
- *Yarns:* long fibers formed by aligned nanotubes HiPco SWCNT
-*Nylon-based SWCNTs nanocomposites:* obtained via *in situ* interfacial polymerization
-*Nanocomposites based on conductive polymers*: PANI-SWCNTs, PEDOT-SWCNTs

- *Silicone-based nanocomposites :*obtained using a blending technique
- *Thermotropic LC -based nanocomposites:* based on LC-SWCNT membranes

Finally the research in course in our labs is aimed at combining different sensing devices based on carbon nanotubes for manufacturing a lab-on-chip hybrid system.