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Over the years, great effort has been made to use carbon nanotubes (CNT) as gas sensing materials with high specific surface area for detection of gases [1, 2]. Our objective is to design and optimize a chemical sensor based on CNT whose sensitivity arises via coupling with a pre-concentration nanoporous silica layer. The detection mechanism is based on the resistance change of CNT upon gas exposure which is due to the p-type semiconducting behavior of the CNTs [3]. Our choice of nanoporous silica as pre-concentrator for the sensor is based on previous work that has shown the ability of various thick nanoporous silica matrices to trap benzene and toluene over the ppb to ppm range [4]. Here we will show that it is possible to use a thin layer of functionalized silica as pre-concentrator to trap and concentrate benzene and toluene at the vicinity of CNT.
The MWCNTs were covered with a nanoporous SiO_2 layer whose function is to concentrate the pollutant in order to enhance the sensor performances. We will describe the preparation of the sensor and highlight the beneficial effects of both the pre-concentration layer and the operating temperature. Thus, the mechanism involved with the functionalized silica layer will be discussed. MWCNT/SiO_2-based sensors operated at 125°C are able to detect 10 ppb of benzene in air. These results underline the potential of this MWCNTs/SiO_2 hybrid material for the detection of indoor and outdoor air pollutants. Recent developments have also demonstrated that this technology can be integrated into a prototype device.

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