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Sommario

Crucial features in gas sensors for environmental monitoring are the gas sensitivity in the low ppb range and the ability to discriminate variations of a certain polluting gas from other interfering gases. Monitoring of ammonia gas concentrations is mandatory to reduce the hazard for human health and vegetation determined by the widespread use of ammonia derivatives as agricultural nitrogen fertilizers, industrial production and traffic. In particular, ammonia, besides being a toxic molecule is one of the main precursors of secondary fine particulate matter (PM10, PM2.5). Ammonia could hence be used as a local marker of secondary fine particulate formation, allowing indirect control of particulate emission sources. In spite of this urgency, the detection of NH_3 concentrations in urban areas with chemiresistor gas sensors (CGSs) has been so far widely overlooked, since the average levels are usually low, i.e. in the 20-30 ppb range, while the CGSs are generally tested by exposure to ammonia in the ppm range. Carbon nanotubes (CNTs), discovered more than 20 years ago, are well known and studied systems for many applications, among which (of course) gas sensing. With respect to commercial electrochemical sensors (mostly based on metal oxide materials), CNTs show a higher physical and chemical stability, better transport of charge to the electrodes and a wide range of possible hybrid architectures and operational features, among which the operation at room temperature, that make them unique materials for gas detection. The main goal of this thesis is to increase the sensitivity to [NH3] and to lower the detection limit (DL), exploring sample preparation strategies of low-cost single walled carbon nanotubes (SWCNT)-based gas sensors operating at room temperature, considering also the response to other interfering gases. Furthermore, effects of metal oxide nanoparticles functionalization and gas response of hybrid layers have been also investigated.

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