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Preferential adsorption of NH3 gas molecules on MWCNT defect sites probed using in situ Raman spectroscopy

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ABSTRACT:

The preferential adsorption of NH_3 gas molecules on multi-walled carbon nanotubes (MWCNTs) was studied using *in situ* Raman spectroscopy. It was observed that the full widths at half maximum of the G band and the intensity ratio I_{2D}/I_G of the MWCNTs decreased significantly during NH_3 gas adsorption at elevated temperatures. These observations were explained in terms of suppressed second-order-defect associated Raman vibrations resulting in a lower disorder Raman band due to ammonia adsorption on the defect sites. Another corresponding effect was a temporary increase in electron doping levels due to ammonia adsorption. This behaviour was accompanied by a drop of *ca*. 2% in the resistance of the MWCNTs corresponding to the occupancy of most of the defect sites. We suggest preferential adsorption of ammonia gas molecules on the thermally activated defect sites of MWCNTs as an appropriate gas sensing mechanism. This knowledge can be used to design and tune the selectivity of ammonia gas sensors.