High sensitive CVD graphene-based gas sensors operating under environmental conditions

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Publication date
2017

Document Version
Accepted author manuscript

Citation (APA)
Ricciardella, F., Vollebregt, S., Polichetti, T., Alfano, B., Massera, E., & Sarro, L. (2017). *High sensitive CVD graphene-based gas sensors operating under environmental conditions*. 1-1. Abstract from Graphene 2017, Barcelona, Spain.

High sensitive CVD graphene-based gas sensors operating under environmental conditions

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Graphene has been widely demonstrated to be a perfect candidate for gas sensing applications thanks to the structural and electronic properties [1]. In this work, we present calibrated graphene-based sensors able to detect NO_2 in the concentration range 0.1 – 1.5 ppm (parts-per-million) and operating under environmental conditions, *i.e.* room temperature (RT) and 50% relative humidity (RH). With a limit of detection (LOD) down to 150 ppb (Fig. 1), the findings are comparable with the best performances reported in the literature [1]. The chemi-resistive devices, realized by the innovative transfer-free process [2], were demonstrated to work in the aforementioned conditions, keeping RH at 50% [1]. Here, the behavior of sensors exposed to large RH variation were further analysed. Devices having same graphene-bar length (206 µm) and different width (2, 5, 10 µm) (inset of Fig. 1), were overall electrically characterized and tested and the obtained findings will be presented. The RH effects were proven to be negligible with respect to the sensors performance (Fig. 2). Therefore, for ranges of RH variations shorter than 30%, the current responses were demonstrated to be related only to the graphene-analyte interaction.

References

[1] F. Ricciardella, S. Vollebregt, T. Polichetti, B. Alfano, E. Massera, P.M. Sarro, Proceedings of IEEE Sensors Conference 2016, ISBN: 978-1-4799-8287-5, 697-699

[2] S. Vollebregt, B. Alfano, F. Ricciardella, A. J. M. Giesbers, Y. Grachova, H. W. van Zeijl, T. Polichetti, P. M. Sarro, Journal, IEEE 29th International Conference on MEMS (2016) 17-20

Figures

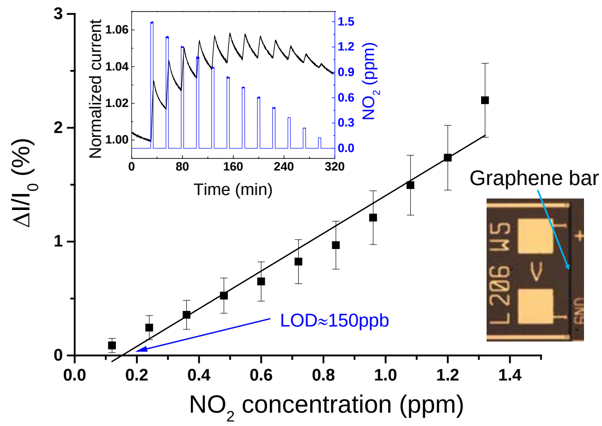

Figure 1: calibration curve of graphene-based chemi-resistive sensor towards NO_2. Right-down inset shows one device geometry (length=206 µm, width=5 µm). Current dynamic behavior of sensor upon exposure to 4 min-long gas pulses (left-up inset). The current is normalized to the value I_0 during the gas inlet of the first pulse exposure.

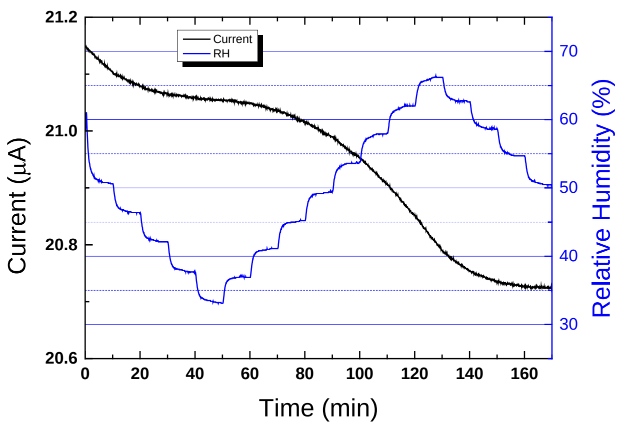

Figure 2: current behavior upon RH variation of graphene-based chemi-sensor showed in Fig. 1.