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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.

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

Filiberto Ricciardella<sup>1</sup>

Sten Vollebregt<sup>1</sup>, Tiziana Polichetti<sup>2</sup>, Brigida Alfano<sup>2</sup>, Ettore Massera<sup>2</sup> and Pasqualina M. Sarro<sup>1</sup>.

<sup>1</sup>Delft University of Technology, Feldmannweg 17, 2628 CT, Delft, The Netherlands

<sup>2</sup>ENEA, Piazzale Enrico Fermi 1, I – 80055 Portici (Napoli), Italy

[filiberto.ricciardella@gmail.com](mailto:filiberto.ricciardella@gmail.com)

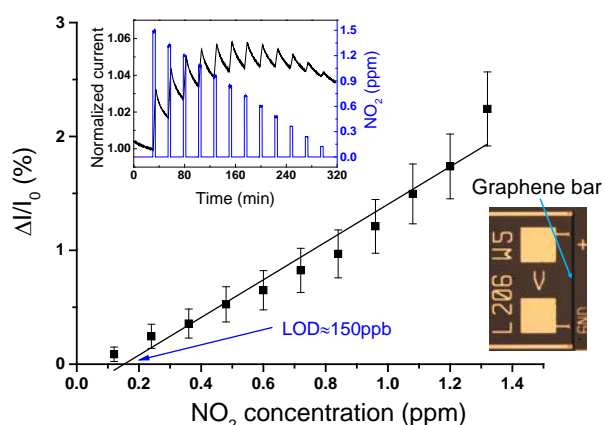
Graphene has been widely demonstrated to be a perfect candidate for gas sensing applications thanks to the structural and electronic properties [1]. In this work, we present calibrated graphene-based sensors able to detect NO<sub>2</sub> in the concentration range 0.1 – 1.5 ppm (parts-per-million) and 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  $\mu\text{m}$ ) and different width (2, 5, 10  $\mu\text{m}$ ) (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

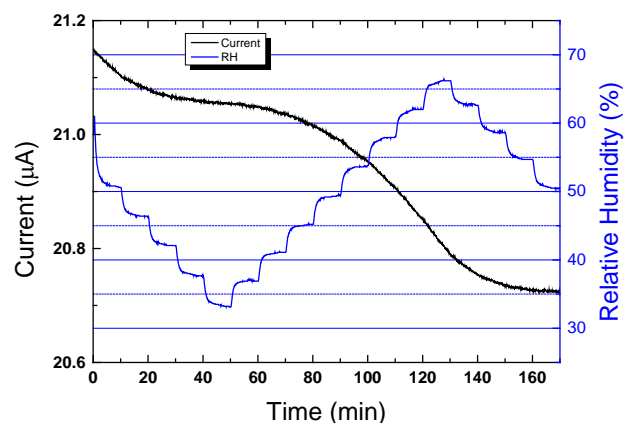
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- [2] S. Vollebregt, B. Alfano, F. Ricciardella, A. J. M. Giesbers, Y. Grachova, H. W. van Zeijl, T. Polichetti, P. M. Sarro, Journal, IEEE 29th International Conference on MEMS (2016) 17-20

## Figures



**Figure 1:** calibration curve of graphene-based chemi-resistive sensor towards NO<sub>2</sub>. Right-down inset shows one device geometry (length=206  $\mu\text{m}$ , width=5  $\mu\text{m}$ ). 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.