

## ppt-Level Detection of CO, NH<sub>3</sub> and H<sub>2</sub> Gases

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### Abstract

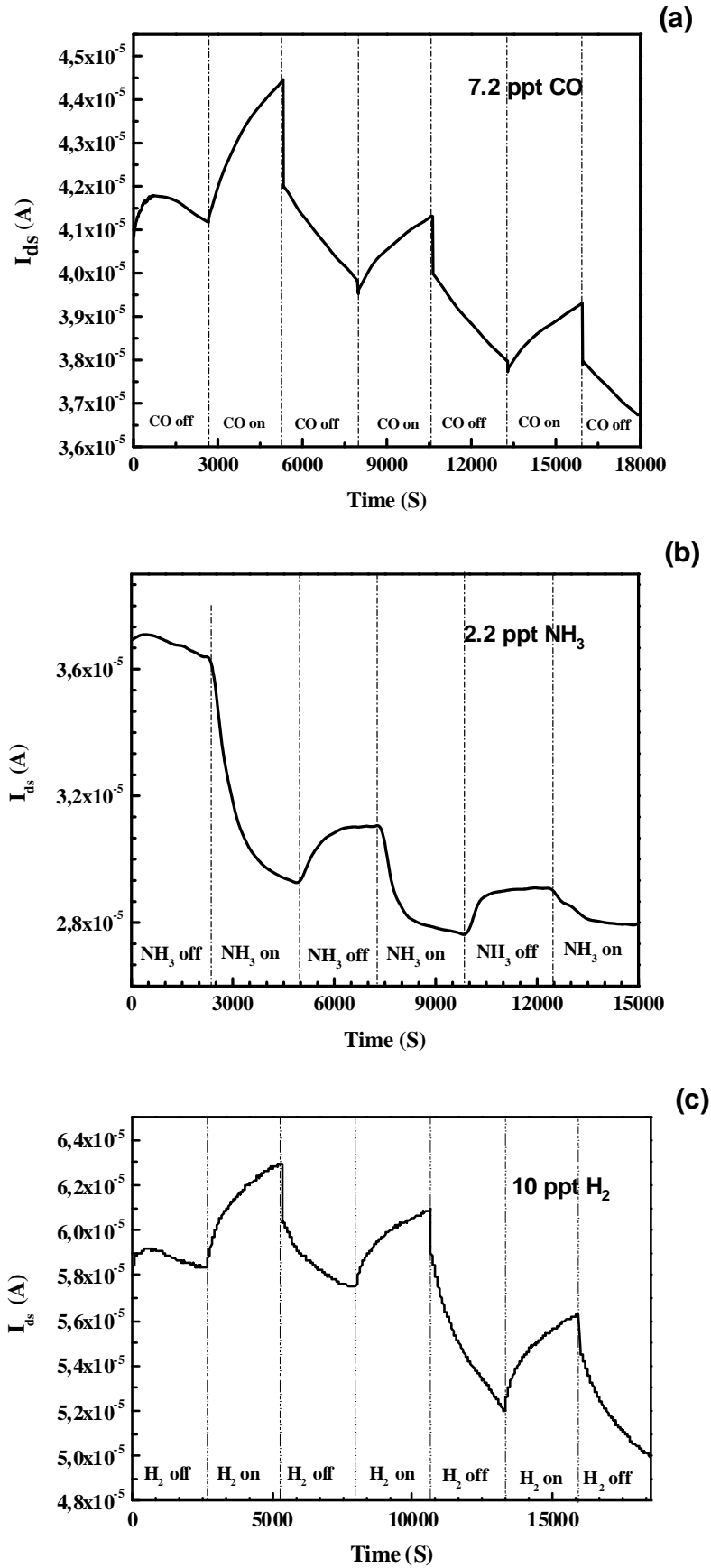
Graphene is widely regarded as one of the most promising materials for sensor applications [1-6]. In the study, carbon monoxide (CO), ammonia (NH<sub>3</sub>) and hydrogen (H<sub>2</sub>) gas sensing behaviors of graphene field effect sensor have been investigated. The measurements are made under  $3.0 \times 10^{-5}$  mbar vacuum environment at room temperature. We demonstrate that a simple two terminal graphene field effect gas sensors can detect gas molecules at extremely low concentrations with detection limits (DLs) as low as parts per trillion (ppt) at room temperature. DLs have been measured as 7.2 ppt, 2.2 ppt and 10 ppt for CO, NH<sub>3</sub> and H<sub>2</sub> gases, respectively.

### References

- [1] F. Schedin, A.K. Geim, S.V. Morozov, E.W. Hill, P. Blake, M.I. Katsnelson and K.S. Novoselov, *Nat. Mater.*, **6** (2007), 652-655.
- [2] J.T. Robinson, F.K. Perkins, E.S. Snow, Z.Q. Wei and P.E. Shehan, *Nano Lett.*, **8** (2008), 3137-3140.
- [3] J. D. Fowler, M. J. Allen, V.C. Tung, Y. Yang, R.B. Kaner, B. H. Weiller, *ACS Nano*, **3** (2009), 301–306.
- [4] G. Lu, L. E. Ocola, J. Chen, *Appl. Phys. Lett.*, **94** (2009), 083111 (3 pp)
- [5] G. Lu, L. E. Ocola, J. Chen, *Nanotechnology*, **20** (2009), 445502 (9 pp)
- [6] V. Dua, S. P. Surwade, S. Ammu, S.R. Agnihotra, S. Jain, K.E Roberts, S. Park, R.S. Ruoff, S.K. Manohar, *Angew. Chem., Int. Ed.* 2010, **12** (2010), 2154–2157.

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**Figure 1** Current vs. time measurement of the sensors for (a) NH<sub>3</sub> (b) CO (c) H<sub>2</sub> gases.