Graphene field effect transistors for detection of volatile organic compounds and simulants of chemical warfare agents

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Graphene is a strong candidate for the development of new gas sensing technologies due to its high surface-to-volume ratio, mechanical strength and flexibility, large conductivity, and low electrical noise. Yet control over material growth and understanding of how material imperfections affect the performance of devices are challenges that hamper the development of applications.[2,3] Here we report our results using graphene field effect transistors based on CVD graphene as gas sensors. Specifically, we monitor the response of graphene chemiresistors while exposed to both the volatile organic compound ethanol and dimethyl methyl phosphonate (DMMP), a nerve agent simulant. On the fabrication side, we report that generally thermal surface treatments after the devices are fabricated lead to improved sensitivity and reduced device-to-device variation. Using such methods, we can detect DMMP vapours at ppb concentration. Supported by theoretical simulations, we discuss our understanding of the mechanisms underlying the sensor's response as well as next steps towards optimizing the graphene sensor's performance.

REFERENCES

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