Green and Cost-Effective Graphene Based Sensors

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Abstract
Sensors have become integral to modern life, contributing to improved safety, increased automation, enhanced energy efficiency, and overall convenience. Several applications have been reported in various domains include among others environmental monitoring and healthcare, home and industrial automation, energy management, security, and transportation. Graphene and its derivatives are considered ideal materials for sensor development due to their excellent properties, which contribute to increased sensitivity, reliability and performance in sensing applications. The two-dimensional structure provides an extensive surface area, increasing sensitivity to environmental alterations, while their tunable electronic properties allow sensors to be customized and tailored for specific analytes. In addition, the combination of green graphene related (GRM) synthesis with state-of-the-art printing techniques further improve the sustainability of sensors and their cost-effectiveness. Graphene's particularly high electrical conductivity enables efficient electron transport, forming the basis for the development of electrodes or sensors based on changes in conductivity, and its mechanical strength and flexibility ensure robust and durable sensors. In this context, capacitive humidity sensors were developed by deposition of graphene oxide (GO) on novel interconnect electrodes fabricated using both additive manufacturing and laser-induced graphene (LIG) approaches. Gas sensors were developed by depositing metal oxides on graphene-based electrodes and temperature sensors by doping CVD graphene with metal chlorides. In addition, strain sensors were fabricated from hybrid films of reduced graphene oxide and other 2D materials.

References

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Figures

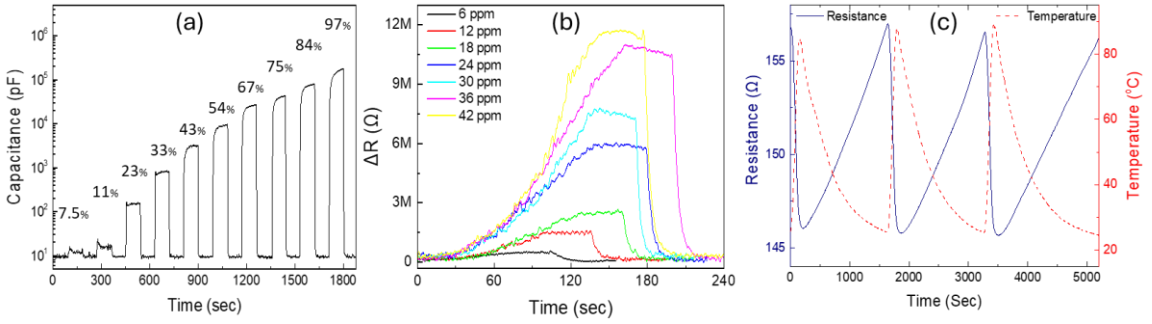

Figure 1: Performance characteristics of graphene based (a) RH sensor, (b) Acetic acid sensor and temperature sensor.