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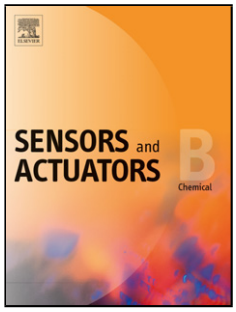

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Reduced Graphene Oxide based Temperature Sensor: Extraordinary performance governed by lattice dynamics assisted carrier transport

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Highlights

- rGO film based extremely sensitive temperature sensor with ~0.1 Kelvin resolution
- Optimization of sensor parameters with rGO concentration in the films
- Impact of carrier drift under electron-phonon scattering
- Lattice dynamics approach linked with carrier dynamics to explain sensing mechanism
- Highly sensitive temperature sensing possible in contact as well as convection mode

Abstract

In this article, we report the sensing performance of reduced graphene oxide (rGO) based resistive type temperature sensor fabricated by spin coating. A detailed analysis is presented for understanding the combined effect of lattice vibrational properties and temperature dependent electrical conductivity while considering charge carrier scattering with phonons, impurities, defects, and edge boundaries of rGO flakes. The purpose of this analysis is to find out how together they influence the temperature coefficient of resistance (TCR) and thermal hysteresis (H_{Th}) of rGO based films. TCR and H_{th} are the core factors for efficient operation of a temperature sensor as these govern important sensing characteristics such as sensitivity, resolution, drift, response- and recovery-time. Experimental results show that the proposed sensor exhibits TCR ~ -0.801 %/K (in 303K–373K) and negligible thermal hysteresis (~0.7%) resulting in high resolution (~0.1 K), response- and recovery-time of ~52s and ~285s respectively. Besides, TCR and H_{th} are also found

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