Enhancing Resistive Humidity Sensors with rGO Resistors for Thermal Compensation

---

Gabriel Maroli[1,2], Robert Kobrin[1,3], Ruslan Álvarez-Diduk[1], Arben Merkoci[1,4]

1- Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and BIST, Campus UAB, Bellaterra, 08193 Barcelona, Spain

2- Instituto de Investigaciones en Ingeniería Eléctrica Alfredo Desages (IIIE), Universidad Nacional del Sur – CONICET

3- Joint Department of Biomedical Engineering, NC State & UNC Chapel Hill

4- Catalan Institution for Research and Advanced Studies (ICREA), 08010 Barcelona, Spain

gabriel.maroli@icn2.cat; ruslan.alvarez@icn2.cat; arben.merkoci@icn2.cat

---

Environmental measurements often require monitoring ambient humidity, with sensors commonly employing capacitive or resistive technologies. While capacitive sensors are commonly used, implementing resistance measurement at the circuit level offers distinct advantages, including greater sensitivity and ease of quantification. However, resistive sensors introduce a significant challenge: their resistance values not only vary with humidity but also fluctuate with temperature. In the case of silver printed sensors, this variation in resistance is due to the positive thermal coefficient of the material. In contrast, carbon-based materials, including reduced graphene oxide (rGO), exhibit a negative thermal coefficient. In most scenarios, temperature-induced resistance variations are negligible. Yet, in extreme environments like deserts, characterized by wide temperature fluctuations, or during measurements in volcanic areas, thermal effects can become substantial. Consequently, it becomes imperative to apply correction or compensation techniques. In this study, we explore the application of rGO resistors in series circuits to counteract the thermal changes observed in silver tracks. Through this innovative approach, we aim to develop humidity sensors that remain temperature-independent, ensuring their accuracy and reliability in environmental monitoring applications.