Investigation of Moisture Sensing Property Regeneration in TrGO-PVA Composites

Lohitha M
Swathi Krishna N, Sandra Rolly, R Sridhar Krishna, Digambar Y Nadargi*
Centre for Materials for Electronics Technology (C-MET), Thrissur. Kerala
d.nadargi@cmet.gov.in

Abstract

Graphene-based polymer composites have emerged as promising candidates for soil moisture sensing applications owing to their high sensitivity, fast response, and cost-effective fabrication. Thermally reduced graphene oxide (TrGO)-polyvinyl alcohol (PVA) composite exhibits exceptional sensitivity to soil moisture through resistance changes. But prolonged exposure leads to hysteresis and diminished responsiveness due to irreversible water retention. This study investigates a facile regeneration of the sensing properties of TrGO-PVA composites. The method employs the incorporation of a Graphene-based conductive ink as a heater element [1][2], which is used to remove absorbed moisture through controlled two preconditioning cycles after every use, each consisting of 60 s of heating at a fixed power of 0.6 W, followed by 20 s of cooling. Water desorption mechanism occurred via hydrogen bond disruption in PVA's hydrophilic chains, while TrGO's conductivity facilitated the rapid evaporation pathways. After regeneration, the sensor shows improved stability, repeatability, and faster recovery. These results indicate that TrGO–PVA composites can be reused effectively for soil moisture sensing applications.

References

[1] Lin, Shu-Yu, Tian-Yu Zhang, Qi Lu, Dan-Yang Wang, Yi Yang, Xiao-Ming Wu, Tian-Ling Ren, *RSC Advances,* 7(43), (2017), 27001
[2] Liu, Lixin, Zhigang Shen, Xiaojing Zhang, Han Ma. Journal of Colloid and Interface Science, 12, (2021), 582.

Figures

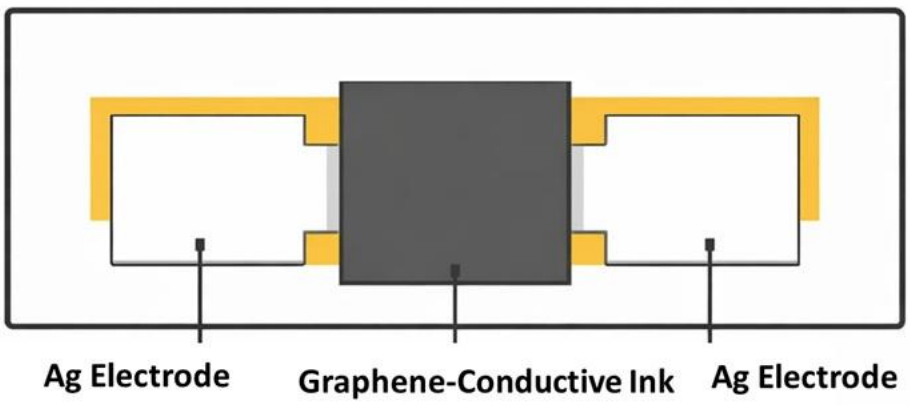

Figure 1: Schematic illustration of the heater patch employed for the regeneration of moisture-sensing in the TrGO-PVA composite