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Sustainable Thin-Film Transistor Platform with Integrated Opto-acoustic Anticounterfeiting Features for Smart Electronics

Nisha Naik[a], Ashok Rao[a], Joydeep Biswas[b], Dhanya Sunil[a],

[a]*Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, India.*

[b]*Department of Chemistry, Sikkim Manipal Institute of Technology, Sikkim Manipal University, Majitar, 737136, Sikkim, India*

Email: a.rao@manipal.edu

Abstract: Thin-Film Transistors (TFTs) have developed from display backplanes to printed, transparent, and conformal forms, flooring the way for next-generation wearable, smart, and secure electronics [1]. TFT-based anticounterfeiting architecture promises significant impact on secure electronics, offering scalable, flexible, and cost-effective protection against product forgery. In the present study, graphene oxide (GO) was prepared by the modified Hummers' method and reduced using ascorbic acid. Furthermore, a NiO/rGO composite was synthesized through microwave irradiation, and its structure was established by XRD, FTIR, XPS, FESEM, and EDX. Commercial phosphor embedded NiO/rGO-based TFT displayed an n-channel behavior with a high on/off current ratio of 1.95×10^6, a field-effect mobility of 0.16 $cm^2/V \cdot s$, and a low subthreshold swing of 0.075 V/decade, highlighting the device's potential for low-voltage, high-performance electronic applications. Furthermore, the TFT integrates built-in optical and acoustic security features, exhibiting blue emission at 475 nm and an audible response under 980 nm laser excitation, as established through visual and audio recordings, corroborates the device's potential as a multifunctional smart, sustainable and secure platform for advanced anticounterfeiting applications [2].

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