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REVIEWER'S REPORT

Manuscript No.: **IJAR-53231** Date: 11-08-2025

Title: Comparative and Machine Learning-Driven Analysis of Reduced Graphene Oxide– Polymer Gas Sensors: Materials and Sensitivity Trends

Recommendation:
Accept as it is .....YES.....
Accept after minor revision.....
Accept after major revision .....
Do not accept (*Reasons below*) .....

Rating	Excel.	Good	Fair	Poor
Originality			✓	
Techn. Quality			✓	
Clarity			✓	
Significance		✓		

Reviewer Name: Mir Tanveer

Reviewer's Comment for Publication.

The manuscript titled *"Comparative and Machine Learning-Driven Analysis of Reduced Graphene Oxide–Polymer Gas Sensors: Materials and Sensitivity Trends"* presents a comprehensive and well-structured review of recent advancements in rGO–polymer gas sensors. The abstract effectively captures the scope, significance, and dual methodological approach of the work, combining both literature survey and data-driven machine learning analysis. The stated emphasis on materials selection, fabrication techniques, and performance metrics, coupled with specialized attention to nitroaromatic vapor detection, provides a clear thematic focus for the study.

The introduction is logically organized and establishes the context of gas sensing within broader domains such as environmental monitoring, industrial safety, and security. The manuscript clearly outlines the advantages of rGO–polymer composites, highlighting their synergistic properties—rGO's high surface area and conductivity with polymers' chemical specificity and flexibility—leading to improved room-temperature sensing performance. The inclusion of key examples of conducting polymers (PANI, PPy, PTh, PEDOT:PSS) and targeted gases (NH_3, NO_2, H_2S, VOCs, nitroaromatics) underscores the wide applicability of these hybrid sensors.

The integration of a machine learning-based analytical framework adds an innovative dimension to the review, moving beyond qualitative discussion to quantitative assessment. The mention of using statistical visualization and Random Forest regression to identify feature importance—particularly the finding that Limit of Detection (LOD) and gas type most strongly influence sensitivity—demonstrates the value of this interdisciplinary approach. The use of comparative radar charts and heatmaps to present performance data strengthens the holistic analysis and reinforces design considerations for future devices.

Overall, the manuscript offers a coherent synthesis of experimental findings and computational insights, providing readers with both a detailed literature overview and an evidence-based perspective on

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performance trends in rGO–polymer sensors. The dual emphasis on environmental and security applications further enhances the practical relevance of the review.