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A GOQD modified IDE-PQC humidity sensor based on impedance-frequency tuning principle with enhanced sensitivity

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Research Highlights:

- A GOQD modified IDE-PQC humidity sensor with digital frequency output was constructed.
- High response sensitivity of the sensor towards humidity was demonstrated.
- It was proved that the sensor was sensitive to both permittivity and conductivity changes of the GOQD sensing film.

Abstract:

In this work, a graphene oxide quantum dots (GOQD) modified IDE-PQC humidity sensor based on the impedance-frequency tuning principle is presented. The proposed sensor consists of an electrically exposed interdigital electrode, which is modified with a GOQD film, connected in series with a piezoelectric quartz crystal. To explain the working principle of the proposed sensor, a contrastive GOQD modified IDE-PQC sensor with a thin insulating layer on the IDE is used in the comparison test. The experimental results showed that the proposed sensor had a high sensitivity of up to 81 Hz/(% RH), and it was ten times more sensitive than the contrastive sensor. It was demonstrated that the proposed sensor was sensitive to both permittivity and conductivity changes of the GOQD sensing film caused by humidity variations while the contrastive sensor could respond only to the dielectric permittivity change. This work introduces a feasible way to construct a digital humidity sensor with high sensitivity.

Keywords:

Humidity sensor; graphene oxide quantum dots; IDE-PQC sensor; quartz crystal.

1. Introduction

The detection of humidity level plays an important role in many fields, such as meteorology, industry, agriculture, medical

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