Enhanced sensitivity of zinc phthalocyanine-based microporous humidity sensors by varying size of electrode gaps

ABSTRACT

The use of organic materials has become an increasingly important issue in sensing devices in recent times. Phthalocyanine is among the most promising materials in this undertaking. Zinc phthalocyanine (ZnPc) based microporous device was fabricated and its capacitance was utilized as the sensing mechanism for a humidity sensor. The effect of the electrode gap of the device on the electrical properties was investigated along with the correlation between the device's performances and the morphology of the sensing film. Using the solution-processed spin coating method, the capacitive type humidity sensor devices have been fabricated in a planar geometry of Al/ZnPc/Al with the presence of a microporous template. The size of electrode gaps measured with a surface profiler was 53.00 ± 0.06 μm, 119.00 ± 0.03 μm and 286.00 ± 0.01 μm. The surface morphology was characterized by using transmission electron microscopy (TEM), field emission scanning electron microscopy (FESEM) and X-ray photoelectron spectroscopy (XPS). Analysis of the experimental results showed that the device with the shortest electrode gap (53.00 μm) produced the best sensitivity of 1.03 ± 0.04 pF/%RH than that of the longer gaps. Additionally, hysteresis as well as response and recovery performances have also been investigated.

Keyword: ZnPc; Organic; Microporous; Electrode gaps; Humidity sensor