Perovskites as surface-assisted room temperature protonic conductor humidity sensor

ABSTRACT

This paper shows a correlation between surface effective porosity due to various sintering regimes and humidity sensitive electrical properties of the perovskite-based bulk type humidity sensors. Furthermore, room temperature humidity transduction mechanism of the thick film type humidity sensors was studied in details through electrochemical impedance spectroscopy (EIS) and major transmissive components were detected by fitting to the equivalent circuits. The materials were synthesized employing solid state reaction and bulk and film type devices were fabricated by hydraulic pressing and screen printing techniques, respectively. The morphological and elemental characterizations were carried on using FESEM, EFTEM, and EDX. Physical properties including open porosity/bulk density were investigated through ASTM methods. An innovative self-designed material test fixture with ceramic supports was fabricated for high S/N ratio electrical measurement of the bulk samples. All the sensors were set up at 20-95% RH. The morphological, physical, and electrical results of bulk pellets indicate direct correlation of the open cavities and AC conduction. Presence of the ionic transport is clearly observed from the frequency-conductance spectra at room temperature. Noise-free detected behavior via EIS proves that proton transfer mechanism is a dominant responsible.

Keyword: Humidity sensing; Perovskite; Barium; Ceramic; Impedance spectroscopy