ABSTRACT

Metal-Organic Framework (MOF) is an organic-inorganic hybrid crystal consisting of metal cations and organic ligands with nano-appearing pores. Due to their large surface area, porosity, and flexible size, MOFs offer high selectivity and sensitivity for gas adsorption. In this research, a development of electrical properties characterization device has been conducted to investigate the change of MOF electronic properties under CO_2 exposure and temperature change. The Mg-811 gas sensor, thermocouple type K max 6675, and plate heater 220V have been used for CO_2 sensor, temperature sensor, and heating element, respectively. The calibration and characterization processes showed that the device works properly at CO_2 concentration of around 500 up to 5000 ppm and temperature of 25℃ to 200℃. We used the device to characterize the IV curve and resistance of MOF MIL-100 (Cr) in cooperation with Natural Activated Zeolite (ZAA) under CO_2 gas exposure from around 500 up to 3000 ppm and temperature variation from 25℃ to 200℃. The I-V characteristic curves of MIL-100(Cr), 50% ZAA@MIL-100(Cr), 70% ZAA@MIL-100(Cr), 90% ZAA@MIL-100(Cr) and 95% ANZ@MIL-100(Cr) showed an increasing of current up to 0.09 µA, 0.11µA, 0.028 µA, 0.021 µA and 0.17 µA, respectively, as well as resistance changes up to 27.8 kOhm, 31.2 kOhm,15.2 kOhm, 52.25 kOhm and 44.82 kOhm, respectively under CO2 exposure. The IV curves achieved maximum value at temperature 200℃ with maximum current of 1.28 µA, 0.04 µA, 0.16 µA, 0.540 µA, and 0.67 µA for MIL-100(Cr), 50% ZAA@MIL-100(Cr), 70% ZAA@MIL-100(Cr), 90% ZAA@MIL-100(Cr) and 95% ANZ@MIL-100(Cr) , respectively. In general, the electrical properties were back to its original state when CO_2 exposure were stopped and the chamber was under vacuum condition except for 70% ZAA@MIL-100(Cr) and 95% ZAA@MIL-100(Cr) in which their I-V curves did not return completely to their original states at vacuum condition. In general, all samples show semiconductor characteristics as well as are sensitive to temperature and CO_2 concentration changes. The highest response is shown by the 90%ANZ@MIL-100(Cr) sample with resistance change of 36% under CO_2 exposure.