INTISARI

Material komposit *Thermoplastic Polyurethane/Carbon Nanotube* (TPU/CNT) banyak digunakan untuk *wearable sensor,* termasuk *wearable sweat sensor* atau sensor keringat. Material TPU/CNT mengombinasikan elastisitas TPU dengan sifat konduktif CNT. Penelitian ini bertujuan untuk mempelajari pengaruh konsentrasi CNT dan variasi geometri sensor terhadap karakteristik resistansi prototipe sensor keringat berbasis TPU/CNT dalam merespon perubahan *degree of wetness* hingga mencapai kondisi jenuh.

Material TPU/CNT dibuat dengan variasi konsentrasi CNT sebesar 1–6 wt%. Prototipe sensor dimanufaktur menggunakan metode *fused deposition modelling* (FDM). Karakteristik sensor dianalisis berdasarkan perubahan resistansi absolut terhadap penambahan volume akuades sebagai representasi keringat hingga mencapai kondisi tunak (*steady state*).

Hasil penelitian menunjukkan bahwa pada konsentrasi CNT rendah (1 wt% dan 2 wt%), sensor tidak menunjukkan perubahan resistansi seiring bertambahnya volume akuades. Namun pada konsentrasi CNT ≥ 3 wt%, resistansi absolut sensor mengalami penurunan seiring peningkatan volume akuades hingga tercapai kondisi jenuh. Selain itu, variasi geometri sensor juga memengaruhi karakteristik resistansi dan kapasitas penampungan keringat. Semakin besar luas area aktif geometri sensor, maka kapasitas penampungan akuades lebih tinggi hingga mencapai kondisi jenuh, meskipun nilai resistansi pada kondisi jenuh juga dipengaruhi oleh konfigurasi lintasan arus listrik pada geometri sensor. Kombinasi konsentrasi CNT dan desain geometri sensor menjadi faktor dalam pengembangan *wearable sweat sensor* berbasis TPU/CNT kedepan.

Kata kunci: prototipe sensor keringat, Komposit TPU/CNT, konsentrasi CNT, variasi geometri, *degree of wetness*, resistansi absolut.

ABSTRACT

Thermoplastic Polyurethane/Carbon Nanotube (TPU/CNT) composite materials are widely used for wearable sensors, including wearable sweat sensors. TPU/CNT combines the elasticity of TPU with the conductive properties of CNT. This research aims to study the effect of CNT concentration and sensor geometry variation on the resistance characteristics of TPU/CNT-based sweat sensor prototypes in responding to the degree of wetness until reaching the saturated condition.

TPU/CNT materials were prepared with CNT concentrations ranging from 1 to 6 wt%. The sensor prototypes were manufactured using the fused deposition modelling (FDM) method. The sensor characteristics were analyzed based on changes in absolute resistance due to the addition of distilled water volume as a representation of human sweat until a steady-state condition was achieved.

The results show that at low CNT concentrations (1 wt% and 2 wt%), the sensor does not exhibit resistance changes with increasing distilled water volume. However, at CNT concentrations ≥ 3 wt%, the absolute resistance of the sensor decreases as the distilled water volume increases until a saturated condition is reached. In addition, sensor geometry variation affects the resistance characteristics and sweat holding capacity. A larger active surface area of the sensor geometry results in a higher distilled water holding capacity before reaching saturation, although the resistance value at the saturated condition is also influenced by the electrical current path configuration within the sensor geometry. The combination of CNT concentration and sensor geometry design is therefore an important factor in the future development of TPU/CNT-based wearable sweat sensors.

Keywords: sweat sensor prototype, TPU/CNT composite, CNT concentration, variation in geometry, degree of wetness, absolute resistance.