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CHALLENGES PERFORMING OUTDOOR AIR POLLUTION MONITORING WITH POLYMER NANOCOMPOSITES

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Abstract

There are number of research papers, where promising results in air pollutants (DMMP, H_2S or VOC) detection with polymer based sensors are reported [1, 2]. Several kinds of polymer based sensors exist, which can be applied in air quality control. That is, conductive polymer sensors, conductive polymer sensors with additives like metal nanoparticles Au, Ag, Pt and Cu or carbon nanotubes. This report focuses on polymer nanocomposites, which consists of non-conductive, elastomer like polymer and carbon nanoparticles as conductive filler.

Performing outdoor measurements every sensor is subjected to grate temperature and relative humidity change. These are important factors, which can considerably impact sensors response character or even make sensor senseless. Laboratory experiments performed by our research team has shown that at relative humidity grater than 75% sensor response considerably decreases [1, 3]. Response decrease of the sensor is explained by additional resistance change mechanism (proton conductivity), which emerges due to water molecule layer formation on the surface of the sensor. At high relative humidity values proton conductivity starts to dominate over conventional electrical resistance change mechanism related to tunneling current decrease between conductive particles due to polymer swelling. It is found that polymer nanocomposite baseline electrical resistance is dependent on temperature of surrounding environment. Nanocomposites were heated from +50^{o}C until –50^{o}C and electrical resistance of the nanocomposite were recorded. Greater baseline electrical resistance change is observed for nanocomposites, where multiwall carbon nanotubes (MWCNT) are used as conductive filler.

References

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