Carbon nanotubes micromechanical and chemical sensors: Reproducibility, reliability analysis and deployment in real use cases

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Abstract

While today's galloping urbanization weighs heavily on both People and Environment and while Climate Change increases natural risks worldwide, Internet of Things Technologies stand at the forefront of the efforts toward Greener Cities. Nanosensors fully integrated into wireless sensor node may become instrumental in this field because of their small size, low cost, versatility and low power consumption. Potential applications are environmental monitoring, structural health monitoring, energy performances monitoring or people exposure monitoring. Challenges range from the manufacturing of the sensors with high reproducibility to their full integration into communicating devices, including ensuring device reliability in complex and harsh environmental conditions.

Carbon nanotubes (CNT) especially are choice material toward this goal, as they have demonstrated both a very strong sensitivity to a variety of environmental parameters and a strong resilience to chemical and mechanical stress. In the present paper, we present a full proof of concept of the use of carbon nanotubes micromechanical and chemical sensors practical use cases, from the reproducible fabrication of the carbon nanotubes sensors [1] to their practical deployment in real life [2]. Two specific examples are discussed, infrastructure durability monitoring and water quality monitoring. Specific methodologies for reliability analysis of carbon-based nanomaterials are also discussed.

References

[1] Michelis et al., Carbon, **2015,** 1020-1026
[2] Michelis et al., IEEE NEMS, 2016
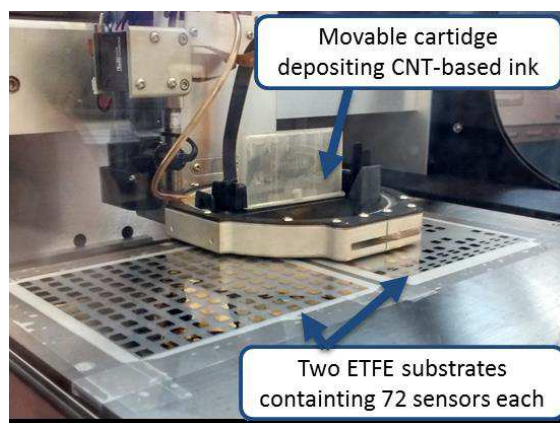
Figures

Figure 1 : Batch fabrication of carbon nanotube sensors by inkjet printing

Figure 2 : Outdoor deployment of CNT sensors in Sense-City demonstrator