Wearable Systems based on Nanomaterials for Health and Safety

Fabrizio MARRA & Alessandro D'ALOIA – *Sapienza University of Rome*

In recent years, there has been considerable progress in the field of wearable technology, specifically in regard to its application to the domain of healthcare monitoring. This progress has been driven by a number of technological advancements, including those in microelectronics, material science, sensors, and actuators. As a consequence of these developments, a multitude of practical applications has emerged, including, for example, smart watches, fitness trackers, and augmented reality (AR) glasses. Such devices must be designed to be flexible, stretchable, and/or twistable, as well as biocompatible, in order to be attached to the human epidermis or implanted within the body. To date, a range of nanomaterials have been implemented in various wearable contexts, including silicon nanomembranes, graphene, carbon nanotubes, liquid metamaterials and other chemical/organic nanomaterials. Nanomaterials are a particular point of attention due to their unique mechanical, chemical and biological properties at the nanoscale. Considerable research has been directed towards developing advanced materials that can be used in work areas where risks commonly associated with shipbuilding, manufacturing, and process industries are present.

It is of interest to identify the optimal technological solution that balances the factors of wearability, multifunctionality, integrability, washability, cost, technological transferability, and performance. In addition, given the wide range of potential applications, it is essential to conduct in vitro tests to evaluate the cytotoxicity and biocompatibility of the sensorized tissues. The sensorized garment must be integrated with communication and data transmission platforms, which facilitate data collection by the sensors and subsequent data analysis using algorithms designed to assess the risk of injury to the worker.