Printable Graphene-Sustainable Elastomer-based Sensors for Point-of-Care Diagnostics

Titash Mondal
Simran Sharma, Muthamil Selvan T
Rubber Technology Centre, Indian Institute of Technology Kharagpur, India
titash@rtc.iitkgp.ac.in

Abstract
Point-of-care diagnostic devices to monitor various healthcare indicators can not only be life-saving but seems quintessential to develop to complement the advancement in artificial intelligence and machine learning to create an IoT-rich healthcare sector. One of the major working arenas to extract useful information from a person's body is the fabrication of body-conformable small strain sensors capable of detecting muscle movement, pulse, and phonetics. Further, the rise in electronics fabrication to create an IoT-based world would also generate a lot of electronic waste. Therefore, epoxidized natural rubber (a sustainable elastomer) and graphene have been leveraged to prepare the requisite sensing device. Epoxidized natural rubber (ENR 50) and graphene interact via oxirane and vinylidene groups, thereby delivering a highly conducting ink. Thus, rheologically optimized inks are stencil printed to develop a single patch that can monitor multiple physiological parameters. Prepared sensors can detect even tiny strains (<1%) with a gauge factor (GF) of 819 and large strains of human skin stretching (<20%) with a GF of 93.5. Moreover, at only 0.49% volume fraction, the percolation threshold has been achieved. To realize the applicability of the sensor in real-time monitoring, it has been attached to an Arduino UNO board and Bluetooth module to wirelessly transfer the data to the mobile phone, thereby providing a promising route to fabricate multifunctional sensors for IoT-based healthcare devices.

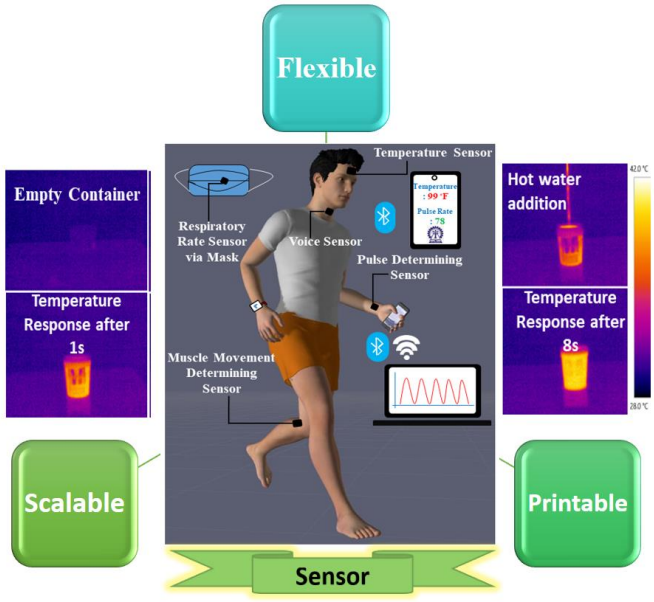

Figure 1: Printable Sensor Based on Graphene-Sustainable Elastomer and its Capability to Decipher Various Physiological Signals.

References

[1] S. Sharma, M. Selvan T, S. Naskar, S. Mondal, P. Adhya, T. Mukhopadhya, T. Mondal, ACS Applied Mater. Interfaces, 14 (2022) 57265
[2] M. Selvan T, S. Sharma, S. Naskar, S. Mondal, M. Kaushal, T. Mondal, ACS Applied Mater. Interfaces, 14 (2022) 45921