2D Materials for ultra-flexible and sustainable electronics

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The aim of obtaining "everywhere electronics" as in wearable technologies, mobile healthcare, sports technology, well-being solutions, and Internet of Things (IoT) applications could fall short, finding in electronic waste (e-waste) a showstopper [1]. Already in 2021 57.4 million metric tons of e-waste has been produced in 2021, with projections indicating an increase to 74.7 million metric tons by 2030. The critical challenge is to develop solutions that not only meet the flexibility required for wearable applications, but also address environmental sustainability due to the e-waste. In this context, two-dimensional (2D) materials are emerging as a promising solution due to their exceptional mechanical properties and versatility. These materials, such as graphene, transition metal dichalcogenides, and hexagonal boron nitride, offer significant potential for creating ultra-flexible and ultra-conformable devices. In addition, the integration of 2D materials with eco-friendly substrates such as paper represents a viable approach to improving environmental sustainability. This abstract explores the role of 2D materials in revolutionizing the design and sustainability of electronic devices, moving from hybrid approaches (i.e., integrating flexible and rigid electronics [2]) to full flexible circuits, and proposes a paradigm shift towards reducing e-waste through innovative materials science, as well as to introduce the needed device complexity (i.e., transistor count) in order to reach the needed functionalities for wearable electronic applications.

References

[1] available at:https://ewastemonitor.info
[2] S. Conti et al., IEEE Journal of Flexible Electronics, Vol. 2, 4, 2023.

Figures

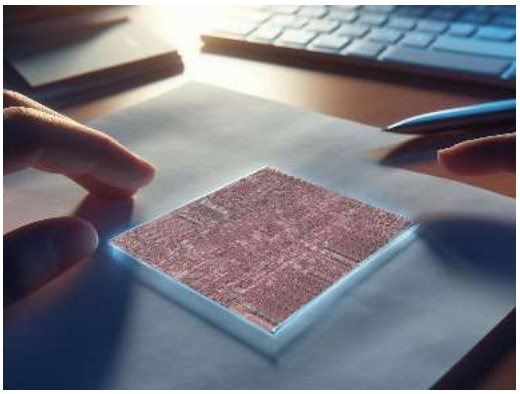

Figure 1. Potential scenario enabled by novel and advanced materials as 2DMs.