Sustainable and Scalable 2D Materials for Wearable Self-Powered Sensing

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The growing demand for autonomous, wearable technologies calls for energy solutions that are not only efficient but also environmentally responsible. Graphene and related two-dimensional (2D) materials stand at the forefront of this transformation, offering a unique combination of flexibility, sensitivity, and energy utilization performance that is redefining the future of self-powered wearable electronics. This presentation explores sustainable and scalable approaches to the synthesis and integration of 2D materials, particularly graphene-based systems, for triboelectric nanogenerator (TENG)-driven wearable sensors [1]. These self-powered devices convert energy from human motion, physiological signals, and ambient vibrations into electricity, providing an eco-friendly alternative to conventional battery-powered electronics, suitable for wearable healthcare and environmental monitoring. Emphasizing green synthesis routes and conscious fabrications, we explore strategies to maintain high material quality while minimizing ecological impact. The talk will highlight advances in device architecture, including textile integration [2, 3] and flexible platforms, and demonstrate how graphene and 2D materials heterostructures can be scaled toward real-world applications. Addressing both the scientific challenges and manufacturing pathways, this work supports the sustainable development of next-generation self-powered wearable systems that meet the growing demands for energy autonomy and environmental responsibility.

References

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