Water-based and biocompatible 2D material inks for printed and sustainable electronics

Cinzia Casiraghi
Department of Chemistry, University of Manchester, Oxford road, Manchester, M13 9PL, UK
cinzia.casiraghi@manchester.ac.uk

Two-dimensional (2D) materials have emerged as promising candidates for the Internet of Things (IoTs) and next-generation wearable electronics, owing to their exceptional properties and compatibility with solution-processed approaches, by enabling the use of simple and cost-effective techniques – such as ink-jet printing- for device fabrication onto flexible substrates.
In this talk, I will present the development of biocompatible, water-based inks of conducting, semiconducting, and insulating 2D materials [1], which are suitable for the fabrication of fully printed electronic devices on flexible substrates, such as paper, including photodetectors [2–3], memristors [4–5], and diodes [6], offering a pathway toward more sustainable printed electronics, following the EU Green Deal strategy.
Moreover, our approach, based on supramolecular chemistry, enables simultaneous exfoliation and functionalization of nanosheets, allowing to produce 2D materials with tailored surface chemistries, specifically designed for sensing and biomedical applications [7-9]. For example, the non-covalent functionalization of h-BN nanosheets with pyrene derivatives—acting as supramolecular receptors—has led to the development of highly sensitive and fast-response humidity sensors. These sensors are particularly well-suited for breath monitoring, capable of detecting subtle variations in inhalation and exhalation patterns [7].

References

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