Exploring the electroanalytical performance of tailored 3D-printable composites in (bio)sensing

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3D printing thermoplastic composites and other rapid manufacturing technologies has gained significant attention for various electrochemical applications, particularly chemical analysis. This is primarily due to low material cost and high accessibility, printout customizability and capability to fabricate on demand, alongside sustainability originating from substrates biodegradability.

Different routes may boost the electrochemical performance of 3D-printed electrodes; the three most notable are 1) heteroatom dopants, 2) post-printing surface treatments referred to as activation and 3) surface engineering by catalytic nanoparticles and thin films. The talk will present our group's recent findings in both of these areas. Recently, new 3D-printable composites have been designed and studied, whose catalytic performance originates from the presence of diamondised nanocarbons as additives. As a result, the detection limits of selected anti-inflammatory drugs, antibiotics, neurotransmitters and many more may decrease significantly. The above study serves as one of many proof-of-concept devices for low-cost, on-demand, and fully customisable 3D-printed cells for rapid environmental screening with high sensitivity.

Moreover, such modified electrodes can accommodate various bioreceptors or respond to external stimuli, which is a relatively facile strategy for biosensor manufacturing. Combining additive-manufacturable microelectrode arrays with complex, machine-learning-aided impedimetric analyses paves the way for a new family of (bio)sensing systems with enhanced sensing capabilities.

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