# Advancing Biosensing with Graphene Derivatives as Efficient Signal Transducers

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Graphene derivatives have attracted considerable attention as functional materials for electrochemical biosensors, thanks to their electrical conductivity, high surface area, and, most importantly, their tunable surface chemistry. Among these, fluorographene (FG)-derived materials stand out due to their unique capacity for covalent modification under mild and well-controlled conditions. FG chemistry enables the synthesis of both single- and double-sided functionalized graphene sheets with precisely engineered surface groups and customizable degrees of functionalization. These features allow for robust and stable covalent immobilization of biorecognition elements, offering clear advantages over noncovalent strategies by enhancing both selectivity and long-term stability of biosensors [1–4].

A significant breakthrough in this field has been the advent of inkjet printing as a scalable, flexible, and cost-effective fabrication technique. FG-derived graphenes are particularly well-suited for inkjet printing, as they combine optimal flake size, colloidal stability, and favorable rheological properties for high-resolution deposition. Fully inkjet-printed electrodes based on FG-derived inks exhibit outstanding electrochemical characteristics, delivering the sensitivity, reproducibility, and robustness required for advanced biosensing platforms [5–6].

This work explores the synergistic integration of FG-derived graphene materials with inkjet printing technology, offering a powerful route to the development of next-generation signal transducers. These platforms demonstrate broad applicability, with adaptability to a wide range of analytes across diagnostics, environmental surveillance, and industrial monitoring sectors [7]. Furthermore, the presented results highlight the role of graphene derivatives as cornerstone materials for future high-performance biosensor technologies.

Finally, emerging opportunities and challenges will be discussed, including scalability, multiplexing capability, and portability, i.e., key factors for translating lab-scale prototypes into real-world, deployable biosensing devices [8,9].

**References**

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