Introducing HEIDI: High Throughput ElectrosynthesIs DevIce for rapid electrosynthetic methodology development and libraries

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Electrosynthesis has emerged as a powerful tool in organic synthesis, enabling unique reactivity under mild, sustainable conditions. However, the demand for high-throughput electrochemical experimentation currently exceeds the capabilities of commercial solutions, which suffer from a combination of high costs, limited throughput or control, operational complexity or unproven translation to larger scales. Compatibility with SBS-based plate formats is also a must in automation laboratories in industrial settings (agro and pharma research, among others).

We present a novel planar electrode array architecture comprising individually isolated cells connected in series. This design simplifies power supply requirements, reduces manufacturing costs, and enables economically viable single-use arrays. Disposable electrodes eliminate cross-contamination between experiments, remove the need for manual cleaning, and improve reproducibility by avoiding performance drift from surface changes.

The arrays are manufactured via outsourced screen-printing, ensuring full chemical compatibility at low cost. The platform supports 96 fully parallel galvanostatic electrochemical reactions (50–300 µL) with integrated thermal regulation, agitation and current control. It accommodates multiple electrode materials (carbon, platinum, nickel, ruthenium dioxide), enabling rapid exploration of diverse reactivity spaces. Applications include reaction discovery, optimization, library synthesis, and metabolite generation, demonstrating the system's utility for industrial-relevant HTE in electrosynthesis.