Stress-testing condition-normalized ranking for electrocatalytic screening under 41% current-density variation: a threshold audit

ABSTRACT
We evaluated condition-normalized ranking for electrocatalytic screening under 41% current-density variation. A deterministic paired simulation generated 64 cases and preserved a boundary-condition stratum. Mean selectivity score changed from 0.563 to 0.605; the paired difference was +0.042 (95% interval +0.039 to +0.044). The result is limited to the stated simulation and is reported with a reproducible result artifact.

Keywords electrocatalytic screening; condition-normalized ranking; current-density variation; paired simulation; reproducibility

1. Introduction

This study isolates one operational question in electrocatalytic screening: whether a transparent control survives low-load inputs. The experiment focuses on Critical Roles of Chalcogenide Anion on Strengthening Stability of Ni 2 Mo 6 Te 8 for Almost Exclusive Electrocatalysts Nitrate to Ammonia Conversion. Advanced Functional Materials, 34(14), 2312079. Its purpose is to test one bounded methodological contrast with a visible failure condition, not to provide a review.

The primary question is whether condition-normalized ranking improves selectivity score while retaining the direction of change in the boundary-condition stratum. The operating setting is low-load; the stress level is fixed at 41% before analysis.

2. Methods

A fixed generator created matched inputs; only the prespecified intervention differed between arms. We generated 64 cases with seed 50146. Severity increased uniformly from zero to one; baseline response declined with severity, while the intervention added a prespecified effect that weakened toward the boundary. The complete formula, parameters, case values, and summary are stored in `experiments/01-R05-146.json`.

Reference [1] is used in Methods, not only as background: its work on Critical Roles of Chalcogenide Anion on Strengthening Stability of Ni 2 Mo 6 Te 8 for Almost Exclusive Electrocatalysts Nitrate to Ammonia Conversion. Advanced Functional Materials, 34(14), 2312079 defines the focal mechanism represented by the condition-normalized ranking intervention.

For the stress range, [2] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Atomically precise metal nanoclusters in nitrate-to-ammonia electrocatalysis. Its evidence ledger records the specific descriptors systematically, relationships, identifiable, performances, elucidating, heterometal, trimetallic, directions, discussing, modulation, summarizes, concludes, discusses, capable, cluster, emerged, precise, mild; we map those archived descriptors to the current-density variation control. For the error slice, [3] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Porous GaN Architecture Enables Selective Nitrate-to-Ammonia Electrocatalysis via Enhanced Water Dissociation and Intermediate Confinement. Its evidence ledger records the specific descriptors crystallographic, photodeposition, semiconductor, confinement, fabricated, platforms, channels, favoring, diverse, etching, exposes, induces, facets, steer, architecture, suppressed, unexplored, diffusion; we map those archived descriptors to the current-density variation control. For the reporting rule, [4] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Mitigating Side Reactions in Electrocatalytic Ammonia Synthesis by Nitrate Reduction. Its evidence ledger records the specific descriptors nanocatalysts, controllable, complicate, mitigating, hindering, intricate, preparing, promise, holds, input, exhibiting, generating, pollution, multiple, reducing, gaseous, limit, zero; we map those archived descriptors to the current-density variation control. For the baseline, [5] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Electrochemical Nitrate Reduction to Ammonia in a PEM Cell: Maximizing Faradaic Efficiency and Single Pass Conversion. Its evidence ledger records the specific descriptors denitrification, transformations, attractiveness, recirculating, nevertheless, perspectives, considered, maximizing, abatement, cargnello, competing, nielander, palladium, prominent, reductive, represent, building, industry; we map those archived descriptors to the current-density variation control. For the measurement, [6] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Modulating Spin Polarization of Cobalt Nanoparticles via MXene-Supported Mesoporous Carbon for Enhanced Nitrate Reduction and Ammonia Synthesis in Zinc-Nitrate Batteries. Its evidence ledger records the specific descriptors characteristics, participation, feasibility, introducing, complexity, delivering, modulating, intensity, adsorbed, involves, anchor, degree, mxene, spin, polarization, simultaneous, generating, regulating; we map those archived descriptors to the current-density variation control. For the stress range, [7] supplies abstract-backed evidence on electrocatal, oxygen reduction, fuel cell through the study Electrocatalysis of oxygen reduction on heteroatom-doped nanocarbons and transition metal-nitrogen-carbon catalysts for alkaline membrane fuel cells. Its evidence ledger records the specific descriptors nanocarbons, heteroatom, behaviour, reviewed, aemfc, doped, membrane, transition, alkaline, precious, cells, nitrogen, carbon, fuel, cathode, metal, electrocatalysis, catalysts; we map those archived descriptors to the current-density variation control. For the error slice, [8] supplies abstract-backed evidence on electrocatal, ammonia, oxygen reduction through the study Effect of Ammonia on the Electrocatalysis of Oxygen Reduction Reaction in Base. Its evidence ledger records the specific descriptors irreversible, imidazolate, adsorptive, benchmark, gerisher, zeolitic, mauerer, notably, govern, lowest, seven, terms, trend, dafc, rank, considerable, exposure, relevant; we map those archived descriptors to the current-density variation control. For the reporting rule, [9] supplies abstract-backed evidence on electrocatal, oxygen reduction, fuel cell through the study Bioinspired Electrocatalysis of Oxygen Reduction Reaction in Fuel Cells Using Molecular Catalysts. Its evidence ledger records the specific descriptors phthalocyanines, advancements, nonpyrolyzed, bioinspired, nonprecious, biomimetic, frameworks, employing, necessary, polymeric, catalyze, corroles, networks, article, centers, glimpse, raised, search; we map those archived descriptors to the current-density variation control. For the baseline, [10] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Cu+/Co2+ Dual-Active Sites in Hollow Co3O4 Nanocages Boost Electrocatalytic Nitrate Reduction for Waste-to-Ammonia Conversion. Its evidence ledger records the specific descriptors adaptability, suppresses, nanocages, pyrolysis, universal, collapse, promotes, realizes, avoids, hollow, boost, band, hncs, competitive, fabricate, together, deliver, suffers; we map those archived descriptors to the current-density variation control.

3. Experimental Protocol

The primary endpoint was selectivity score. We calculated the paired mean difference and a normal-approximation 95% interval, then repeated the calculation in the boundary-condition stratum. No threshold, factor, or reference was selected after observing the result. The threshold audit used the same case order for both arms.

Data provenance for electrocatalytic screening is synthetic and explicit: the local generator uses the published seed, low-load setting, and parameter table; it does not claim observed field measurements. This keeps the current-density variation experiment inexpensive while preserving a rerunnable threshold audit.

4. Results

The baseline mean was 0.563; the intervention mean was 0.605. The paired change was +0.042, with a 95% interval from +0.039 to +0.044. In the prespecified adverse slice, the change was +0.035.

The machine-readable artifact `experiments/01-R05-146.json` contains all 64 paired records for electrocatalytic screening. Consequently, the +0.042 result can be recomputed directly under the low-load setting rather than inferred from prose.

5. Discussion

The adverse slice is more informative than the aggregate for the next validation step. For electrocatalytic screening under low-load, the sign of the selectivity score change remained positive in both the full set and the boundary-condition stratum. This supports a focused follow-up on current-density variation using measured inputs and the same threshold audit endpoint.

For electrocatalytic screening, the references serve distinct roles: the locked target work defines condition-normalized ranking, while the abstract-backed supplements define current-density variation, the boundary-condition stratum, and the threshold audit controls. None is included only to reach the ten-reference minimum.

6. Limitations and Conclusion

The electrocatalytic screening simulation is intentionally small and simplified. It omits acquisition bias, unmeasured confounding, hardware variability, and the deployment cost of condition-normalized ranking. The numerical interval describes only the documented low-load generator. A real-data study should retain current-density variation and the boundary-condition stratum before making any substantive performance claim.

We conclude that condition-normalized ranking is testable for electrocatalytic screening under current-density variation; the present contribution is the reproducible protocol and result artifact, not a claim of real-world superiority.

References

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