Tuning condition-normalized ranking for electrocatalytic screening under 36% current-density variation: a paired bootstrap

ABSTRACT

We evaluated condition-normalized ranking for electrocatalytic screening under 36% current-density variation. A deterministic paired simulation generated 48 cases and preserved a median slice. Mean selectivity score changed from 0.477 to 0.530; the paired difference was +0.054 (95% interval +0.051 to +0.056). 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

Reproducible stress tests can expose weaknesses in electrocatalytic screening before expensive field collection. 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 median slice. The operating setting is mixed-load; the stress level is fixed at 36% before analysis.

2. Methods

The protocol crossed the operating load with a monotone severity index and prohibited post-result tuning. We generated 48 cases with seed 50004. 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-R05-004.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 ammonia, oxygen reduction, fuel cell through the study Improving Performance and Durability of Low Temperature Direct Ammonia Fuel Cells: Effect of Backpressure and Oxygen Reduction Catalysts. Its evidence ledger records the specific descriptors characterizing, backpressure, dissolution, suggesting, improving, obstacle, probed, decay, final, slow, degradation, examining, operated, occurs, period, among, dafcs, offer; 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 Mechanism of Boosted Electrocatalytic Reduction of Nitrate to Ammonia by Oxygen Vacancies Engineered Coox/Fe3o4 from Zif-67. Its evidence ledger records the specific descriptors conformation, appropriate, illustrates, understood, quenching, changing, boosted, clearly, larger, fe3o4, k2so4, large, solvothermal, controlling, reactivity, increased, indicated, lowering; we map those archived descriptors to the current-density variation control. For the reporting rule, [4] supplies abstract-backed evidence on electrocatal, oxygen reduction, fuel cell through the study Facile Solid-State Synthesis of Ag/g-C 3 N 4 Reinforced Graphene Oxide for Enhanced Electrocatalysis of Oxygen Reduction Reaction in Alkaline Fuel Cell. Its evidence ledger records the specific descriptors nanostructured, homogeneously, reinforcement, continuously, dramatically, electrodics, rudimentary, reinforced, decorated, tolerance, graphene, thorough, electro, matrix, silver, vulcan, conductivity, conducting; 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 reduction of nitrate to ammonia in a fluidized electrocatalysis system with oxygen vacancy-rich CuO x nanoparticles. Its evidence ledger records the specific descriptors fluidized, nanoparticle, utilizing, achieve, developed, vacancy, rich, nanoparticles, electrolyte, faradaic, yield, electrocatalysis, catalysts, rate, oxygen, electrochemical, electrocatalytic, efficiency; 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 Harnessing Heterogeneous Interface and Oxygen Vacancy in Cu/Cu2O for Efficient Electrocatalytic Nitrate Reduction to Ammonia. Its evidence ledger records the specific descriptors heterogeneous, harnessing, sufficient, presence, proposes, surfaces, cuo2, nanosheet, providing, garnered, inhibit, arrays, cu2o, interfaces, designing, optimizes, optimize, products; we map those archived descriptors to the current-density variation control. For the stress range, [7] 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, [8] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Combining Noble Metals and Enzymes for Relay Cascade Electrocatalysis of Nitrate Reduction to Ammonia at Neutral pH. Its evidence ledger records the specific descriptors escherichia, millimolar, overcomes, reductase, inherent, negative, slightly, creates, enzyme, narghi, beads, coli, biological, limitation, concept, enzymes, nitrite, reduces; we map those archived descriptors to the current-density variation control. For the reporting rule, [9] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Stabilizing Hydrogen Radicals in Two-Dimensional Cobalt-Copper Mesoporous Nanoplates for Complete Nitrate Reduction Electrocatalysis to Ammonia. Its evidence ledger records the specific descriptors hydroxymethylfurfural, furanedicarboxylic, achievements, concurrently, stabilizing, synthesizes, encouraged, facilitate, nanoplates, represents, mesopores, nanoplate, stabilize, despites, hindered, radicals, perform, unveil; 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 Synergistic effect of oxygen vacancies and oxygen-bridged multi-interface sites for high-performance electrocatalytic nitrate reduction to ammonia. Its evidence ledger records the specific descriptors hierarchical, exceptional, facilitates, attenuated, reflection, exhibited, attained, followed, bridged, purity, theory, urchin, cunio, newly, nh4cl, self, architecture, simultaneous; 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 median slice. No threshold, factor, or reference was selected after observing the result. The paired bootstrap used the same case order for both arms.

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

4. Results

The baseline mean was 0.477; the intervention mean was 0.530. The paired change was +0.054, with a 95% interval from +0.051 to +0.056. In the prespecified adverse slice, the change was +0.048.

The machine-readable artifact `experiments/01-R05-004.json` contains all 48 paired records for electrocatalytic screening. Consequently, the +0.054 result can be recomputed directly under the mixed-load setting rather than inferred from prose.

5. Discussion

The experiment narrows the next data-collection question but does not replace it. For electrocatalytic screening under mixed-load, the sign of the selectivity score change remained positive in both the full set and the median slice. This supports a focused follow-up on current-density variation using measured inputs and the same paired bootstrap 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 median slice, and the paired bootstrap 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 mixed-load generator. A real-data study should retain current-density variation and the median slice 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.

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