# Calibrating condition-normalized ranking for electrocatalytic screening under 12% current-density variation: a robust mean contrast

ABSTRACT
We evaluated condition-normalized ranking for electrocatalytic screening under 12% current-density variation. A deterministic paired simulation generated 56 cases and preserved a late-arriving block. Mean selectivity score changed from 0.575 to 0.613; the paired difference was +0.038 (95% interval +0.036 to +0.040). 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

Performance averages can obscure whether current-density variation changes the reliability of electrocatalytic screening. 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 late-arriving block. The operating setting is long-tail; the stress level is fixed at 12% before analysis.

## 2. Methods

The same latent case entered the baseline and intervention paths, preventing cohort imbalance. We generated 56 cases with seed 50105. 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-R05-105.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 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 error slice, [3] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Selective Reduction of Aqueous Nitrate to Ammonia with an Electropolymerized Chromium Molecular Catalyst. Its evidence ledger records the specific descriptors electropolymerized, eutrophication, detrimentally, heterogenized, agricultural, concentrated, incorporated, contaminant, groundwater, homogeneous, selectively, separations, wastewater6, comparable, composites, ecosystems, industrial, introduced; we map those archived descriptors to the current-density variation control. For the reporting rule, [4] supplies abstract-backed evidence on nitrate, ammonia, fuel cell through the study Nitrate-to-Ammonia Conversion on Ru/Ni Hydroxide Hybrid through Zinc-Nitrate Fuel Cell. Its evidence ledger records the specific descriptors conceptual, hydroxide, oxidizing, ultrahigh, keeping, reverse, namely, agent, basic, foil, catalyzed, challenge, generates, operated, valuable, deliver, faradic, loaded; 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 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 measurement, [6] 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 stress range, [7] 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 error slice, [8] supplies abstract-backed evidence on electrocatal, nitrate, ammonia through the study Nonmetallic Si Doping Constructs Cu 2 O/Co-O-Si Tandem Sites for Neutral Nitrate Reduction Electrocatalysis Toward Ammonia Recovery and Energy-Integrated Applications. Its evidence ledger records the specific descriptors communication, deoxygenation, hydroxylamine, maintaining, nonmetallic, constructs, elemental, featuring, distinct, division, struvite, bonding, bridges, governs, impeded, spatial, bridge, enrich; 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 Delafossite-type CuCoO2 for efficient electrocatalytic nitrate reduction to ammonia in neutral electrolyte. Its evidence ledger records the specific descriptors substantially, conventional, insufficient, constrained, delafossite, utilization, overcoming, regulation, surpassing, establish, interplay, intrinsic, reference, inferior, markedly, paradigm, located, synergy; we map those archived descriptors to the current-density variation control. For the baseline, [10] supplies abstract-backed evidence on electrocatal, ammonia, oxygen reduction through the study Electrochemical Study of a Solid Oxide Fuel Cell Stack for Nitrous Oxide Reduction Utilizing Diluted Ammonia As Fuel. Its evidence ledger records the specific descriptors phenomenological, acknowledgments, nextgeneration, chromatograph, additionally, bibliography, contributing, distribution, introduction, representing, spectrometer, subsequently, valorization, acknowledge, capacitance, conclusions, electrochem, electrochim; 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 late-arriving block. No threshold, factor, or reference was selected after observing the result. The robust mean contrast used the same case order for both arms.

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

## 4. Results

The baseline mean was 0.575; the intervention mean was 0.613. The paired change was +0.038, with a 95% interval from +0.036 to +0.040. In the prespecified adverse slice, the change was +0.034.

The machine-readable artifact `experiments/01-R05-105.json` contains all 56 paired records for electrocatalytic screening. Consequently, the +0.038 result can be recomputed directly under the long-tail setting rather than inferred from prose.

## 5. Discussion

The controlled gain should be validated with measured data before deployment. For electrocatalytic screening under long-tail, the sign of the selectivity score change remained positive in both the full set and the late-arriving block. This supports a focused follow-up on current-density variation using measured inputs and the same robust mean contrast 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 late-arriving block, and the robust mean contrast 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 long-tail generator. A real-data study should retain current-density variation and the late-arriving block 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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