PROJECT TITLE: Geometric Efficiency in Biochemical Reactors

Reducing Metabolic Friction via Topological Field Modulation

Applicant: Genaro Carrasco Ozuna (TCDS Institute)
Funding Request: ACS Corporation Associates Seed Grant
Total Amount: $20,000.00 USD
Duration: 12 Months

1. BUDGET SUMMARY

Cost Category	Description	Amount (USD)
A. Hardware & Prototyping	Reactor Construction (CSTR), Field Generators, Sensors	**$8,500.00**
B. Materials & Consumables	Biological Substrates, Catalytic Interfaces (Graphene/Cu)	**$4,000.00**
C. Computational Resources	OmniKernel Simulations (HPC), Kinetic Modeling Software	**$4,500.00**
D. Dissemination & Travel	ACS Meeting Presentation, Open Access Publication Fees	**$3,000.00**
TOTAL REQUESTED	**Capital Seed Investment**	**$20,000.00**

2. DETAILED JUSTIFICATION

A. HARDWARE & PROTOTYPING ($8,500)

Construction of the "TCDS-CSTR v2.0" Pilot Reactor for physical validation of geometric catalysis.

Item	Cost	Justification / Technical Spec
Custom CSTR Vessel (5L)	$2,500	Fabrication of a chemically resistant reactor (PEEK/Titanium) with specific hexagonal internal geometry. Designed to test fluid dynamics under non-Hermitian topological confinement.
Field Modulators (FPGA)	$3,000	High-precision Helmholtz coil array driven by an FPGA controller. Essential to induce the "Phase Locking" fields (Σ_{ext}) required to reduce entropic friction in the substrate.
Sensor Suite (IoT)	$3,000	Industrial-grade sensors for pH, ORP (Redox), Dissolved Oxygen, and Mass Flow Controllers. Crucial for real-time verification of the predicted increase in metabolic yield (Y_{bio}).

B. MATERIALS & CONSUMABLES ($4,000)

Operational inputs for comparative experimental runs (Control vs. Active).

Item	Cost	Justification / Technical Spec
Biological Substrates	$1,500	Standardized biomass samples and specific methanogenic archaea

		consortia. Required to run A/B testing against standard Monod kinetics baselines.
Catalytic Interfaces	$2,500	Raw materials for the internal "Geometric Catalyst" surfaces. Includes CVD Graphene sheets and high-purity Copper needed to construct the boundary layers that minimize friction (Φ).

C. COMPUTATIONAL RESOURCES ($4,500)

Digital Twin validation ensuring the physical results match theoretical predictions.

Item	Cost	Justification / Technical Spec
HPC Cloud Time	$3,000	Rental of GPU instances (AWS/Google Cloud) to execute "OmniKernel" fluid dynamics simulations. Validates the $Q \cdot \Sigma = \Phi$ model before physical runs to save material costs.
Software Licenses	$1,500	Licenses for specialized chemical kinetic modeling software (e.g., Ansys Chemkin or similar) to benchmark our topological results against industry standards.

D. DISSEMINATION ($3,000)

Reporting results to the ACS and the broader chemical engineering community.

Item	Cost	Justification / Technical Spec
ACS Meeting Travel	$2,000	Travel, lodging, and registration to present the "Entropic Audit Methodology" directly to the ACS Corporation Associates committee and industry partners.
Publication Fees	$1,000	Article Processing Charges (APC) for publishing the final technical report in a high-impact Open Access chemical engineering journal.

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3. PROJECT TIMELINE & MILESTONES

Quarter	Phase	Deliverable / Milestone
Q1	**Procurement & Setup**	Reactor assembly completed; FPGA control system calibrated.
Q2	**Baseline Testing**	Control runs (standard geometry) completed; Monod kinetics baseline established.
Q3	**Active TCDS Runs**	"Active Geometry" runs completed; Data on metabolic efficiency boost collected.
Q4	**Analysis & Report**	Final comparative analysis;

		"Entropic Audit" paper drafted; Presentation at ACS.