SEM TECH

SALT ELECTRO MINING

Rowow LLC

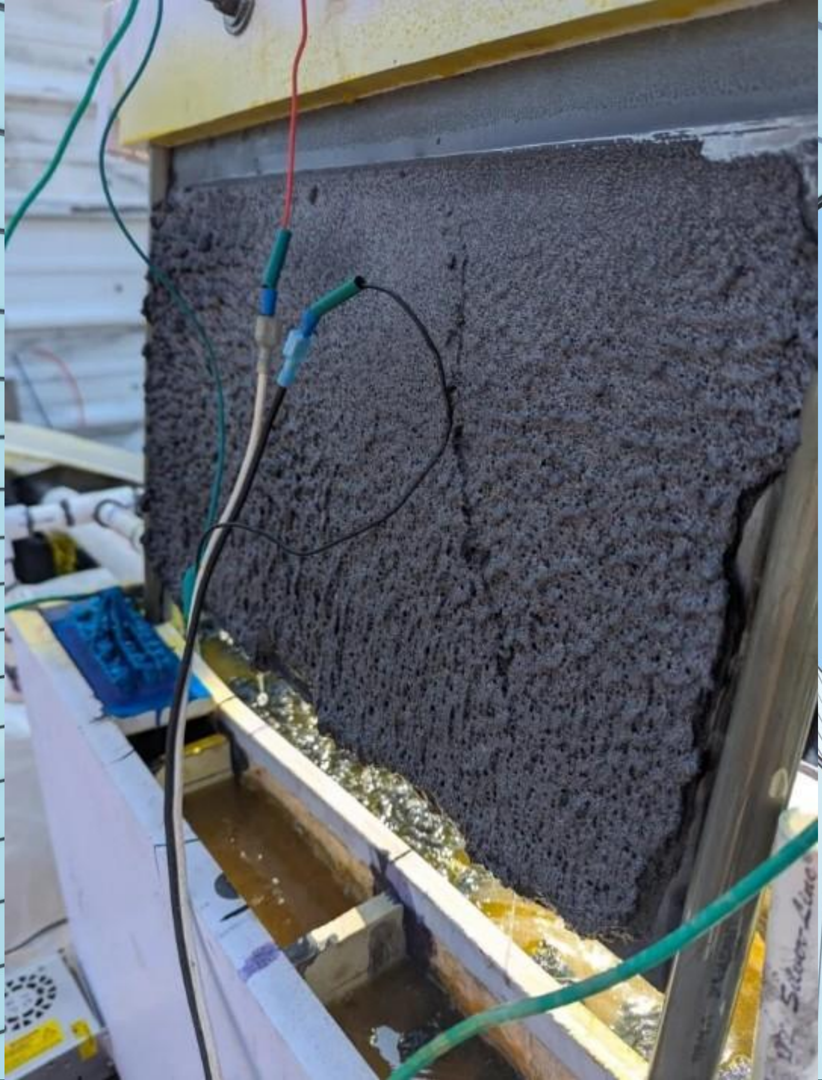
Rowow LLC
2/11/2026

What is SEMTECH?

SEM TECH is an open-source Salt Electro Mining Technology that uses saltwater and electricity to extract precious metals, rare earth elements, and critical minerals. In our continuous mining unit, we use hydrochloric acid (HCl) and sodium chlorate as the leaching solution—both derived from saltwater and electricity.

The solution has a strong oxidizing redox potential (ORP) of over 1.5 V at pH 0. Under these chlorine-rich conditions, it can dissolve noble metals such as rhodium, platinum, and gold, among others. Metals like silver, tin, and selenium are also oxidized and dissolved.

Because of our closed-loop architecture, we can achieve recovery yields of up to 99% at costs as low as $50 per ton. The system has a small footprint—comparable to (or smaller than) a vacuum filtration unit of similar capacity. You can feed in toxic, heavy-metal-bearing rock and produce concentrated powder along with clean silt that is safe for agricultural use. The process generates zero environmental pollution. With SEM TECH, we turn waste into a profitable commodity.



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Based on the updated 2025 list of 60 critical minerals, SEM TECH is capable of extracting all but 4 minerals. 53 of those elements can be extracted and concentrated by the CMU in a single leaching solution. The remaining 3 elements can be extracted by SEM TECH utilizing the same components, only requiring a slight modification to which leaching solution is being utilized. CMU is not designed to directly extract Barite, Fluorspar, Metallurgical Coal, and Graphite because these are primarily recovered as native mineral/compound resources rather than as extractable dissolved elemental species. Synthetic pure Fluorspar (CaF_2) may be created from elements extracted by SEM TECH.

Beyond those four, CMU is capable of extracting the remaining critical minerals listed in the following.
(Aluminum, Antimony, Arsenic, Beryllium, Bismuth, Boron, Cerium, Cesium, Chromium, Cobalt, Copper, Dysprosium, Erbium, Europium, Gadolinium, Gallium, Germanium, Hafnium, Holmium, Indium, Iridium, Lanthanum, Lead, Lithium, Lutetium, Magnesium, Manganese, Neodymium, Nickel, Niobium, Palladium, Phosphate, Platinum, Potash, Praseodymium, Rhenium, Rhodium, Rubidium, Ruthenium, Samarium, Scandium, Silver, Tantalum, Tellurium, Terbium, Thulium, Tin, Uranium, Vanadium, Ytterbium, Yttrium, Zinc, Zirconium)

Can be all extracted and concentrated by the CEU in one leaching solution. Silicon, Titanium, Tungsten, would require different solvents and solutions (Hydrofluoric acid, or alkaline leaching conditions) to be extracted by SEM TECH as the CMU utilizes chlorine based acids to digest elements.

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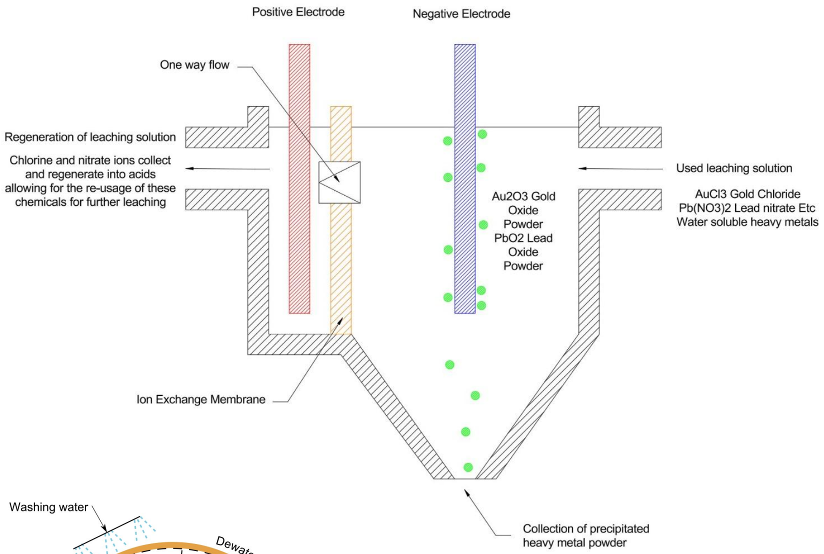
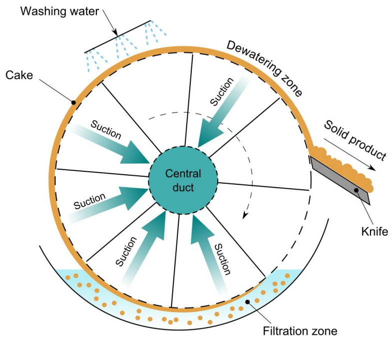




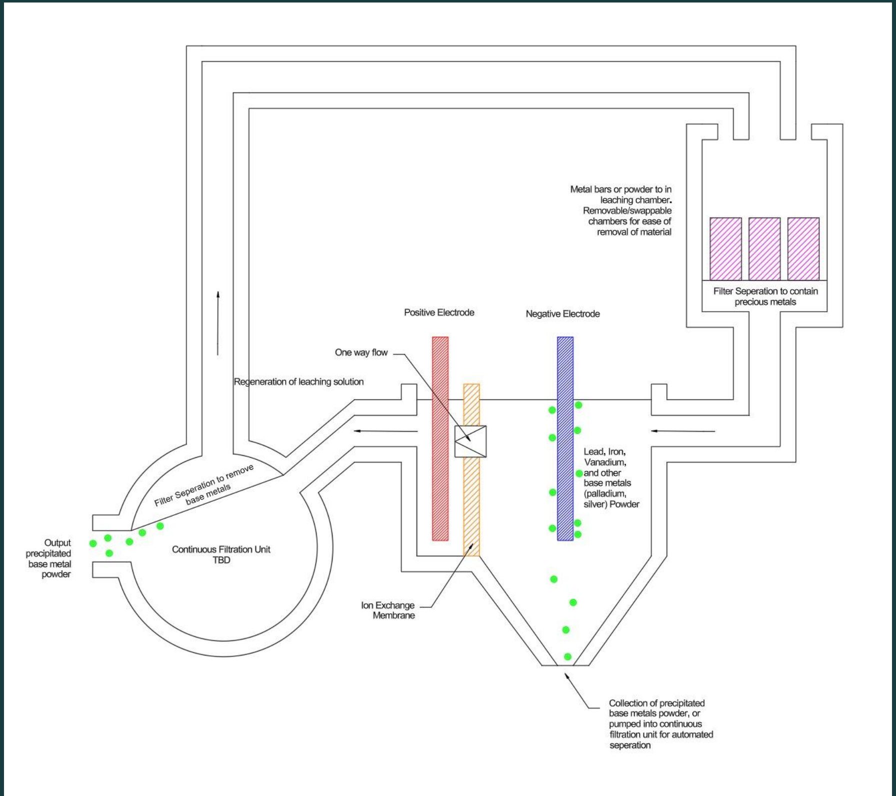
SPOTLIGHT

CMU

Continuous Mining Unit

In the CMU (Continuous Mining Unit), the process operates as follows: First, the acidic leaching solution is regenerated at the anode. It then flows into a leaching tank—or into a slurry system paired with a continuous vacuum filtration drum—where it leaches the ore. The solids are separated from the liquid, and the resulting metal rich leachate is pumped to the cathode side. There, the dissolved metals are reduced and plated out as a powder. This powder settles and is collected at the bottom of a cone tank. The now-depleted solution then returns to the anode, where it is regenerated again via the cation exchange membrane, completing and repeating the cycle.

While multiple leaching configurations are possible, a continuous vacuum filtration drum is preferred for efficient solid–liquid separation. These drums typically include a secondary spray-wash section to rinse the material and neutralize trace amounts of chlorine.



SPOTLIGHT

CRU

Continuous Refining Unit

In addition to the CMU (Continuous Mining Unit), the CRU (Continuous Refining Unit) operates on the same underlying principle but uses different solutions to selectively separate and refine metals. Specific acids can be chosen to remove base metals from the powder produced by the CMU—or from doré bars and other metal feedstocks—enabling continuous refining.

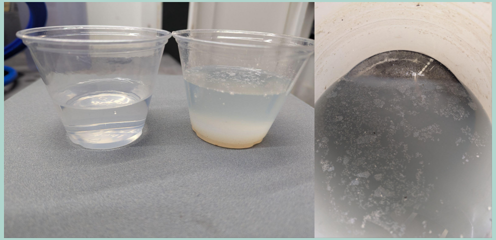
For example, using nitric and acetic acid, base metals can be dissolved while gold and other precious metals remain, allowing them to be continuously concentrated and recovered. The choice of acid can be further tailored, repeating cycles to target different metals depending on the composition of the feedstock.

THE OPPORTUNITY

SEM TECH and the CMU can process a wide range of feedstocks, including mining waste and tailings, toxic chemical waste, e-waste, industrial byproducts, and many other materials. We have successfully treated diverse ore types as well, including high-sulfide and other complex-matrix feedstocks.

Mining liquid waste

Clear mining waste ran through multiple filtration methods had its heavy metals reduced within 5-10 minutes at a cost of $5 a ton, while recovering and regenerating the acid



Refining Dory Bars

Our CRU processed a complex dory bar that traditional nitric acid would not touch due to the complex alloy formed by the vanadium/chrome/etc resulting in a complex alloy similar to hastelloy. Our refining unit leached out these alloyed metals without issue.

Broad Elemental Recovery

Analysis with a Rigaku NEX DE Spectrometer verifies our claims showing a diverse spectrum of rare earth elements and critical minerals extracted. Additionally third part analysis verified our capability of extracting extremely noble metals such as Rhodium, traditionally completely untouched by harsh acids such as aqua regia.

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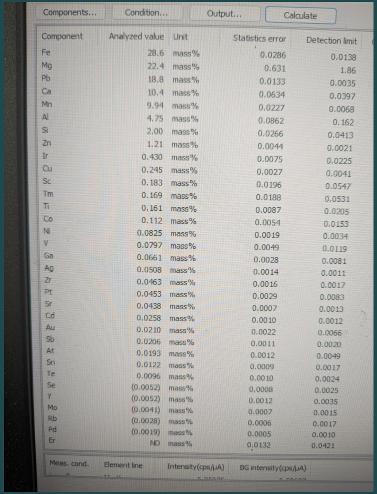
Evidence

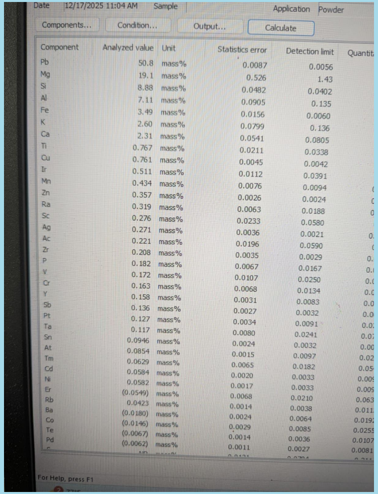
Don’t believe our words, Look at the results

Note: Disregard any Iridium readings as this is a common byproduct error of x-ray spectrum analysis with the presence of lead. Although our ORP (oxidizing redox potential) is capable of dissolving iridium.

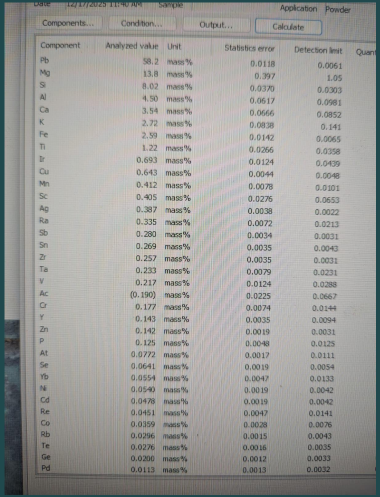
Platinum, Gold, Gallium, Cobalt



Various Heavy Metals



Pd, Ge, And many REM/CM



(Third Party) Rhodium Important to verify leaching capability

Beyond the mining process itself, the key breakthrough enabling this technology is our ion-exchange membranes. We developed an in-house formulation using water softener resin and PVC cement. While traditional ion-exchange membranes can cost up to $400 per square foot, ours cost under $1 per square yard.

We have also field-tested these membranes for months in harsh, acidic mining conditions with no observable decline in performance. Finally, we patented the membrane and released it as open source under the Creative Commons Zero (CC0) 1.0 Universal license, dedicating it fully to the public domain. We believe this enabling technology can impact countless industries—from agriculture and energy storage to fuel cells, waste treatment, and beyond.

https://github.com/Rowow1/Open-sourced-off-the-shelf-ion-exchange-membrane

OUR MISSION

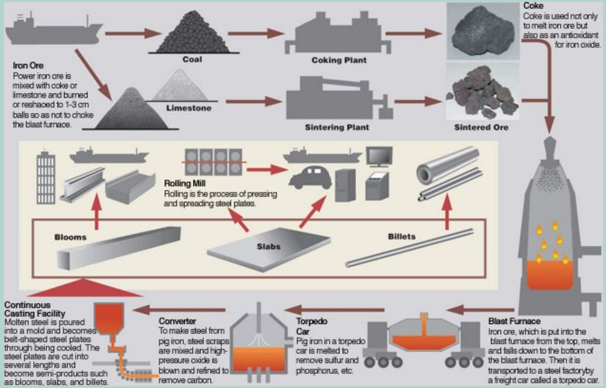
Open source is a core motivation behind our work. Robert's early career—and much of his inspiration—came from the RepRap 3D printer community in its earliest days. The idea of self-sustainability through a printer that could print another printer left a lasting impression on him. One of Robert's favorite quotes from RepRap creator, Adrian Bowyer, is:

"When my child's feet grow, I just take [her old shoes], run them through the shredder with a little bit of extra plastic (bottle) and print out a new pair of shoes 1.1 times as big and the child has got a new pair of shoes that fit again."

Two decades later, RepRap helped shape what became a major force in the 3D-printing world—a technology now used by countless companies and individuals. Yet their open-source approach didn't hold them back. In fact, while many companies rose and fell over those years, RepRap impact endured, showing that open-sourcing a key enabling technology can create an entire industry where both the founders and the broader world benefit.

A similar opportunity exists here. The battery industry alone is projected to reach roughly $500 billion. SEM TECH can help unlock advances in areas like redox flow batteries—an important technology historically constrained by the high cost of ion-exchange membranes. By open-sourcing this enabling membrane technology, existing research can move more easily from the lab to real-world commercial production, delivering broad benefits on a global scale.

"Everyone wants to change the world but no one wants to try."
Lets Try?



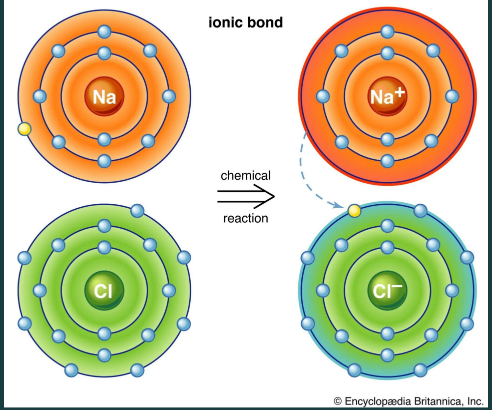
THE PROBLEM

All life and industry ultimately depend on chemistry. Even processes like producing concrete or steel are fundamentally chemical—not simply a matter of “heat it up and pour out the metal,” as many people assume.

Take steelmaking, for example: it begins as a reduction process, where coal (or carbon) reacts with iron oxide (rust) to reduce it into pig iron and CO2. Oxygen is then reintroduced to refine that pig iron by removing impurities and excess carbon, producing slag as a waste byproduct and yielding steel with a lower carbon content. As any chemist will tell you, in traditional chemistry, half of the work comes after the reaction—cleaning and purifying the product you just made.

THE SOLUTION

Electro Chemistry works fundamentally directly at the problem, because all of chemistry is determined by electron interactions.



Electrolysis acts directly on chemical molecules to drive reactions, but without control it can be self-defeating. For example, when you electrolyze saltwater, sodium hydroxide forms at the negative electrode and chlorine forms at the positive electrode. Without a separator, those products mix and react with each other, effectively undoing the chemistry you just created.

An ion-exchange membrane solves this by keeping the two sides separated while allowing specific ions to pass through. That level of selectivity lets you manage reactions with far greater precision—down to the movement of ions and electrons—so there's much less opportunity for loss. In that sense, ion-exchange membranes are often described as a form of "nanotechnology," because they enable control at extremely small scales.

Another way to think about it is that ion-exchange membranes help you manage entropy. When you apply a voltage (charging), you create an imbalance between the two sides of the membrane. When you draw power through a load (discharging), that imbalance moves back toward equilibrium and releases usable energy. This is the basic operating principle of a redox flow battery—an energy storage approach that can reach costs around $5 per kWh, compared with lithium-based systems that are often over $100 per kWh.

Ion-exchange membranes aren't magic, and they do have constraints—for example, they require compatible, conductive solutions to operate effectively. But with thoughtful design, many of these limitations can be addressed. Ultimately, what has held back this next wave of electrochemical technologies is the cost of the membranes—an issue we've tackled and open-sourced.

Why Rowow LLC?

Our primary competitive advantage isn't a single piece of technology—it's perspective. As many have noted, what we've developed is simple and intuitive. It's so straightforward that many people respond with, "How did no one think of this before?" The logic is clear and the results speak for themselves—but it requires the willingness to approach familiar problems from a different angle.

Take the Continuous Mining Unit, for example. It uses ion-exchange membranes in a novel way to recover dissolved metals from solution. Traditionally, these membranes are used in open-loop systems: acid is purchased, ore is leached, metals are recovered, and the remaining solution is discharged as waste. Closing the loop by routing the cathode stream back to the anode can seem counterintuitive, because the opposing solutions would normally neutralize each other. However, the ion-exchange membrane biases ion transport in a way that favors one direction, preserving a potential difference and allowing the cycle to continue. It's an unconventional approach—but it becomes obvious once you step outside traditional assumptions.

The same mindset applies to our membrane formulation. Instead of relying on the conventional (and complex) process of post-functionalizing membranes, we start with pre-functionalized resin—widely available and far easier to work with—then use it to produce ready-to-use membranes. The result is a simpler, more accessible manufacturing pathway without sacrificing performance.

Costs and Consumables

SEM TECH involves various operating costs and consumables, but the core system is designed around hot-swappable components—such as electrodes, membranes, pumps, valves, and electronics—so repairs are quick, downtime is minimized, and maintenance is straightforward.

Electrodes

We currently use coated graphite electrodes, which typically last 2–3 months depending on usage and the leaching solution. At present, 50A electrodes cost about $100 in materials and time at lab scale. One key area Rowow LLC plans to invest in is improving electrode longevity and cost by mass-producing our own in-house glassy carbon and MMO electrodes, which can last for years.

Membranes

We haven't experienced a membrane failure even after months—nearly a year—of continuous use. The membranes themselves are extremely inexpensive, and the entire assembled membrane frame structure costs under roughly $20–$50, mostly in cnc/fabrication time.

Electrical Components

Power supplies, monitoring sensors, pump speed controls (VFDs), and related hardware are inexpensive, straightforward, off-the-shelf components selected specifically for reliability and easy replacement—even in a worst-case scenario.

Mechanical Components

We use a magnetically driven, acid-resistant pump to circulate the leaching solution, along with a vibratory/ultrasonic mechanism to dislodge plated powder from the cathode. We also integrate a continuous vacuum filtration drum—an industrially proven technology—for reliable solid–liquid separation.

Overall costs?

Each feedstock has its own processing requirements. For example, leaching largely inert quartz is far less costly than treating high-sulfide ore, which can require aggressive chemical "burning" (oxidation) to break down sulfur. Under an electricity rate of $0.15/kWh, operating costs typically fall in the $50–$200 per ton range. Industrial power is often $0.08/kWh or lower.

Having an engineering mindset, I prefer to build in a generous margin of error. At residential electricity rates, I estimate SEM TECH operates at roughly $50–$400 per ton, with component replacement

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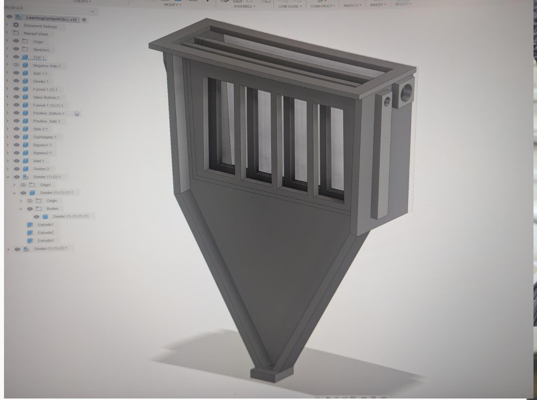
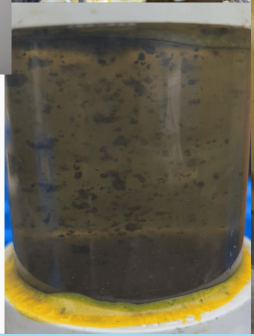
Future

Plans and Objective?





Scale Up

Rowow has already run SEM TECH at the 10–50 lb scale and produced materials with verified results. The next step is to scale to a system capable of processing tons per day—an essential threshold for economic viability in mining, since ore and e-waste are relatively low-value feedstocks (roughly $1,000–$5,000 per ton). Reaching the ton per day scale will require initial R&D and the development of basic manufacturing capacity, particularly for electrodes.

Mass Production

The next step is scaling into mass production so we can manufacture these electrolysis cells—and their supporting components—cost-effectively at volume. We also need the right lab space and analytical equipment to run accurate mass-balance testing on ore samples down to the ppb level. So far, we've only scratched the surface of what this technology can do.

How you can help

Help us share the technology, spread the word, and connect us with media and collaboration opportunities. Our main goal is to scale the system and secure proper funding for continued development. Scaling isn't a DIY challenge—it's an economic one, and it requires real resources.

Reach out:

irowow@gmail.com
Florida USA
https://rowow.net/
https://www.youtube.com/@Rowow/videos

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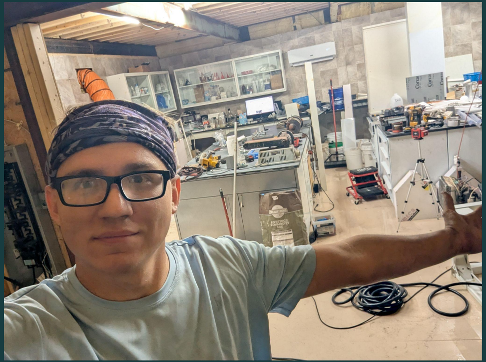
Existing Work

Rowow LLC has already built a dedicated laboratory for this open-source technology. Beyond the roofing, framing, and concrete (shown in the first photo), Robert constructed everything else himself in just three months—including the exterior and interior walls, insulation, mezzanine, cabinetry, electrical work, and more.



DOE GRANT Examples of Cost

To the right is an example of the costs required to scale the technology properly and responsibly, both to build a fully developed pilot-scale system and to establish mass-manufacturing capability. Some items, such as WDXRF and ICP-MS, are high-end laboratory instruments that require specialized lab space and costly installation, and the equipment itself represents a major expense.

Budget

Category	Year 1	Year 2	Year 3	Total
Lead Researcher Team Salary	$300,000	$300,000	$300,000	$900,000
Administrative Team Salary (Indirect Cost)	$150,000	$150,000	$150,000	$450,000
Accounting/Office (Indirect Cost)	$50,000	$50,000	$50,000	$150,000
Labor/Employees (4)	$250,000	$250,000	$250,000	$750,000
Chemists/Technicians (2-3)	$200,000	$200,000	$200,000	$600,000
Chemical Engineer (1)	$180,000	$180,000	$180,000	$540,000
Purchasing new ICP-MS	$450,000	$0	$0	$450,000
Purchasing new WD-XRF	$350,000	$0	$0	$350,000
Manufacturing Equipment	$0	$400,000	$500,000	$900,000
Injection Molding Equipment	$0	$0	$700,000	$700,000
Vacuum Filtration Equipment	$0	$200,000	$0	$200,000
Safety Equipment	$180,000	$0	$0	$180,000
Supplies/materials/chemicals	$50,000	$200,000	$200,000	$450,000
Property/Facility	$2,500,000	$0	$0	$2,500,000
Third party analysis services	$50,000	$50,000	$50,000	$150,000
Facility modifications	$75,000	$25,000	$50,000	$150,000
Travel/Insurance/Utilities/Misc (Fringe Benefits)	$160,000	$260,000	$260,000	$680,000
Cost Share				
Federal Total				
Total	$4,945,000	$2,265,000	$2,890,000	$10,100,000

THE OPPORTUNITY

One of our biggest takeaways from 2025 was that some expenses simply can't be avoided—or DIY'd. We spent over a year trying to analyze our materials using improvised, low-cost chemical methods and saw little meaningful progress. We also learned the hard way how difficult it is in the U.S. to find labs with the specialized expertise required for platinum group metals, since most primary production and deep technical capability is concentrated in places like Russia and South Africa. We even attempted to cut costs with a low-priced Chinese XRF unit and ended up getting scammed. Some fundamentals can't be shortcut: proper tools, materials, and skilled labor cost money.

With the right funding, our progress accelerated quickly. We moved from a rough prototype built from whatever parts we could find to properly manufactured equipment made with appropriate materials. Early on, something as simple as clear PVC sheet felt out of reach. Even now, we've only scratched the surface.

Potential applications for SEM TECH’s ion-exchange-membrane electrolysis platform

As SEM TECH’s core stack manufacturing and mining-unit buildout matures, the same electrochemical architecture can be adapted to adjacent membrane-electrochemical systems with minimal redesign—often by reusing the existing cell hardware.

Fuel cells (electrochemical power generation)
Membrane fuel cells convert hydrogen directly into electricity. Additionally ethanol, methanol, or ammonia can be fed directly into these fuel cells, converting directly into electricity and only emit carbon dioxide+water (no other harmful gasses like NOX, carbon monoxide, particulates, etc)
Example companies: Toyota; Hyundai Motor Company; Plug Power

e-Methanol (power-to-liquids)
Electrolysis produces hydrogen from water, which is then combined with captured CO_2 to synthesize methanol (an e-fuel and chemical feedstock).
Example companies: European Energy; Liquid Wind; Carbon Recycling International

Redox flow batteries (long-duration energy storage)
Flow batteries use liquid electrolytes separated by ion-selective membranes to provide scalable, long-cycle grid storage.
Example companies: Sumitomo Electric Industries; ESS Inc.; Invinity Energy Systems

Hydroponic nutrient & pH control (recirculating systems)
Electromembrane ion management can support tighter nutrient balance, pH stabilization, and water reuse in controlled-environment agriculture and hydroponics.
Example companies: Netafim; Priva; Autogrow

Salinity-gradient power / “blue energy” (reverse electrodialysis / osmotic power)
Membrane stacks can generate electricity from the ionic gradient between high-salinity and low-salinity water streams (e.g., brine + fresh water).
Example companies: SaltPower; REDstack; Statkraft

Broader electrochemical manufacturing (chlor-alkali and other separations)
Ion-exchange membranes are central to large-scale electrochemical processes (e.g., chlor-alkali) and can extend to other acid/base and salt separations.
Example companies: thyssenkrupp nucera; Asahi Kasei; Chemours

These are real technologies with real research paper and real working units. This is not theory or speculation.

Thank you!!!

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