THE IONIC AGE

How a thin sheet of plastic can sort atoms, and why it matters.

S.E.M TECHNOLOGY
Unlock Ionic Potential
youtube.com/@Rowow

EACH AGE IS NAMED FOR WHAT WE LEARNED TO CONTROL

YOU ARE HERE →

STONE	BRONZE	IRON	STEAM	ELECTRIC	ATOMIC	SILICON	IONIC
3.3 million yr ago	3300 BC	1200 BC	1760s	1880s	1945	1954	NOW
shape	*mixture*	*heat*	*pressure*	*voltage*	*nucleus*	*information*	***the ion***

FIRST PRINCIPLES: MOVE ONLY THE ATOMS YOU WANT

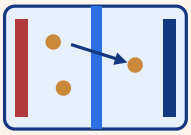
To get metal out of rock the old way, a furnace heats the whole rock before anything happens. Electricity can grab charged atoms (ions) and move just those. **Smelting steel burns 4,000 to 6,000 kWh per ton. Physics says it needs about 2,000.** Heating everything costs 2 to 3 times what physics needs.

heat it all



furnace

move only the ions



membrane cell

LIFE FIGURED THIS OUT FIRST

MITOCHONDRIA
in every cell you have

Pumps protons across a membrane, then lets them flow back through a turbine 10 nanometers wide. That flow powers you.

CHLOROPLAST
in every green leaf

The same trick, run on sunlight. The flow across its membrane turns air and water into sugar. Every meal you eat came through one.

NITROPLAST
found 2024, in ocean algae

Pulls nitrogen out of the air at ocean temperature, inside a membrane. Nitrogen builds the proteins and DNA in your body.

Energy, carbon, nitrogen: life runs its three hardest reactions inside a membrane.

WHERE MEMBRANES ALREADY WORK

Chemicals
Salt water in. Chlorine, lye and hydrogen out, each in its own room.

Energy
Fuel cells and flow batteries turn chemicals into electricity and back.

Water and food
Makes cheese whey gentle enough for a baby's kidneys, so it can go into formula. Keeps crystals out of wine.

Metals (our work)
Regenerate the acid and pull metal straight out of rock and waste.

A membrane you can make for about $1 a square foot.

Commercial sheet costs hundreds of dollars a square foot in the small quantities a maker can buy. Ours is made from water softener resin and PVC cement, and the recipe is free.

1. Grind the resin to powder →
2. Mix it into PVC cement →
3. Spread thin and let it dry

Build videos (YouTube)

PVC cement gives off solvent vapor. Work outdoors or with strong ventilation, wear gloves and eye protection, and keep it away from flames. Students: build this only with an adult.

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

TURN OVER →

Ion exchange membrane electrolysis: how far it goes

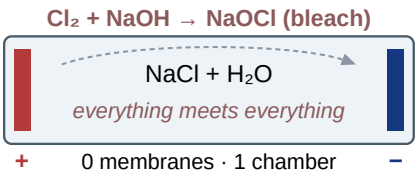
Each step up changes the walls, and the same electricity makes something new.

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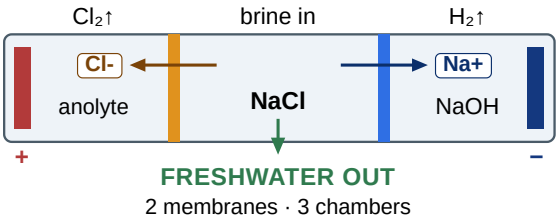
Unlock Ionic Potential

anode (+) · cathode (−) · cation membrane · anion membrane · bipolar membrane · water-free liquid · ceramic wall



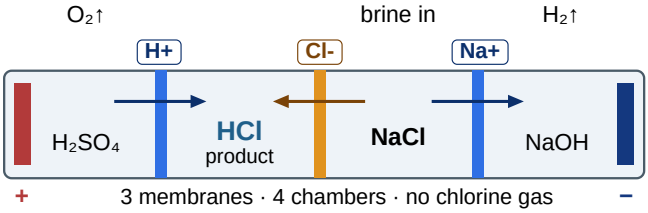
LEVEL 0 · One pot, no walls.

Chlorine from the positive side drifts over and mixes with lye from the negative side. You get bleach. Nothing is separated yet.



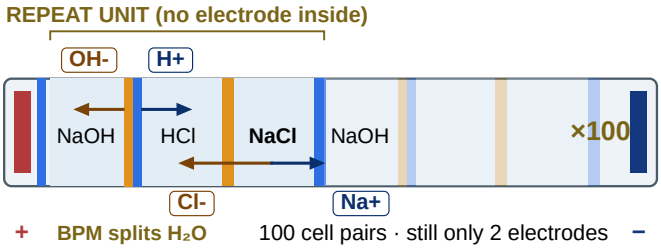
LEVEL 1 · Two membranes, three rooms.

A cation membrane passes only positive ions, an anion membrane only negative ones. The salt splits apart and the middle room runs out as fresh water.



LEVEL 2 · Four rooms, and no chlorine gas.

With sulfuric acid at the anode, only oxygen and H+ form. The H+ meets chloride in the next room and makes hydrochloric acid. Same salt, a different product.

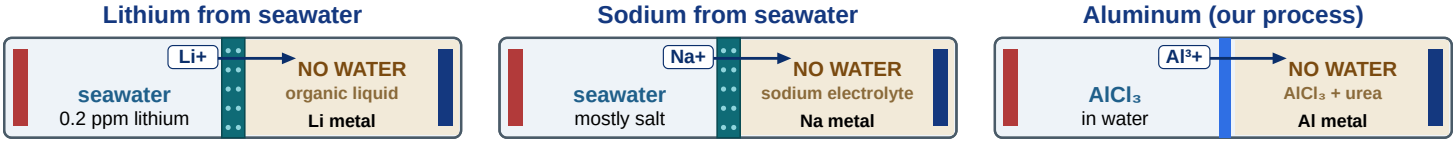


LEVEL 3 · The membrane becomes the reactor.

A bipolar membrane splits water into H+ and OH- on its own. Stack 100 of them between one pair of electrodes and every electron does 100 jobs on its way across.

LEVEL 4 · Fancy walls and water-free liquids

Some metals react with water, so the far side holds none at all, and the wall picks which ion may cross.



LISICON ceramic

A ceramic that passes only lithium.
Shown in Joule, 2018.

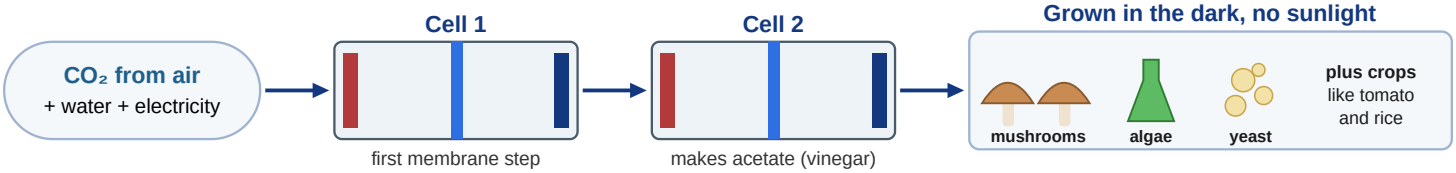
NASICON ceramic

A ceramic that passes only sodium.
Shown in a 2022 seawater cell study.

cation membrane

Aluminum ions cross and plate as metal.
Our design, patent pending.

LEVEL 5 · Chain cells together: food from air and electricity



Algae grew 4 times more energy-efficiently than by photosynthesis, yeast 18 times better than on corn sugar (Nature Food, 2022).

See the builds, videos and files

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Rowow LLC, Florida · open-source membranes and cells · CERN-OHL-S v2