Electrodialysis for in-line tartrate stabilisation

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- Winery Engineering Association (WEA) Annual Conference
- Nuriootpa 24th & 25th June 2009
- Stuart Thomson – Sales & Operations
- Memstar Pty Ltd

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Electrodialysis for tartrate stabilisation

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- Technique developed by Eurodia in conjunction with INRA (French National Institute for Agricultural Research)
- Memstar is the licensee for ED technology in Australia and New Zealand
- Service that is part of its range of mobile wine treatment services and available for Rental and Sale

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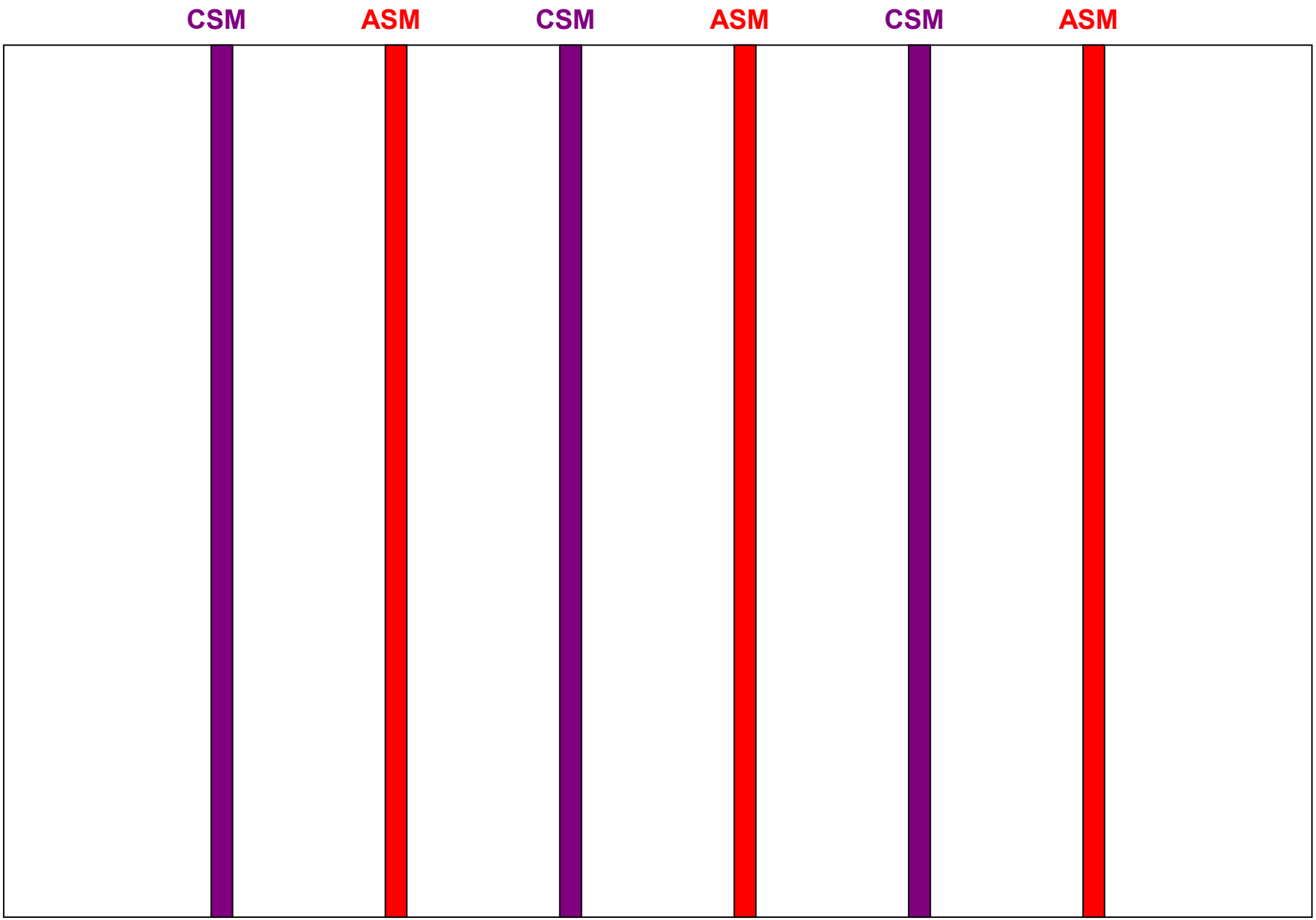
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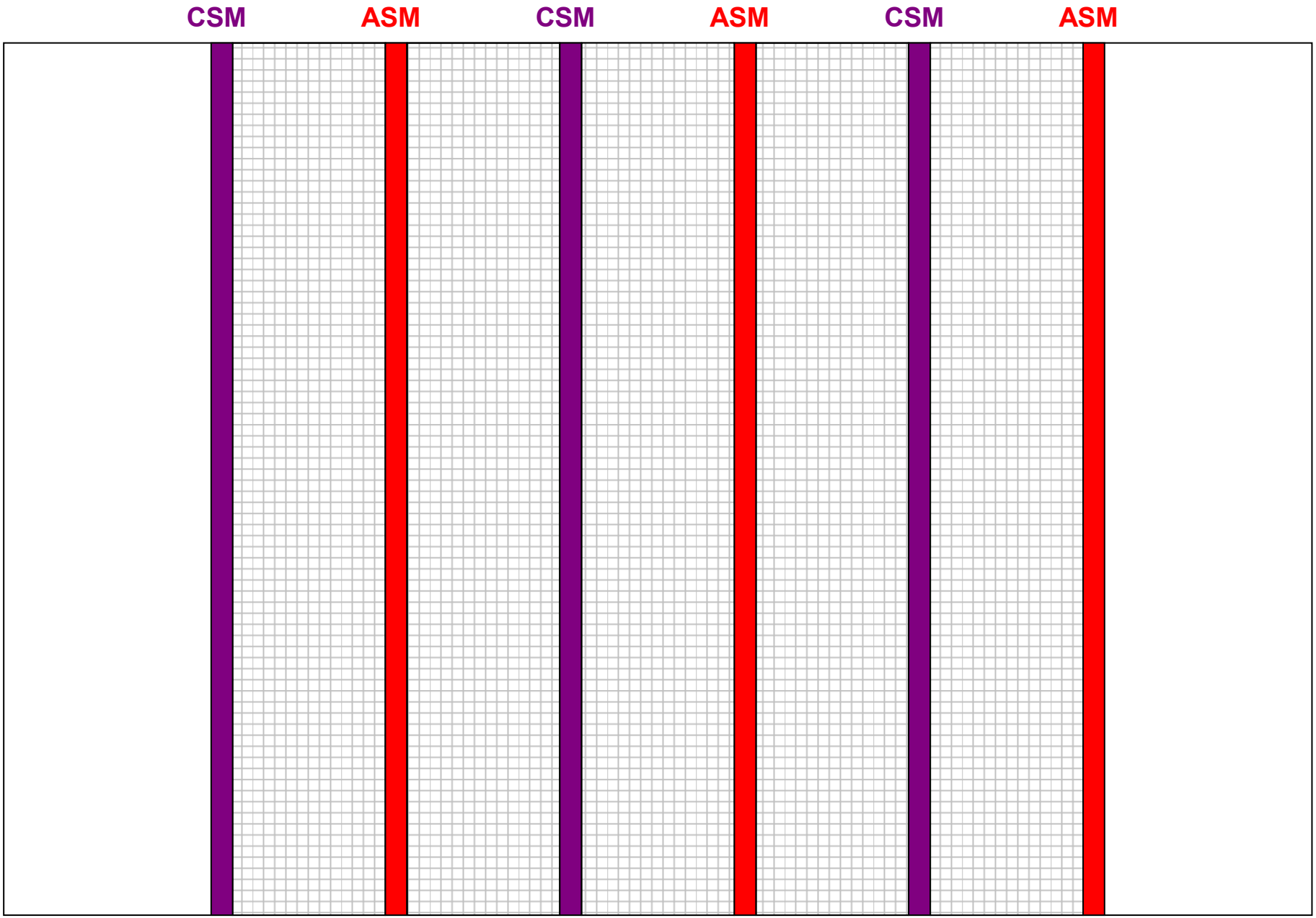
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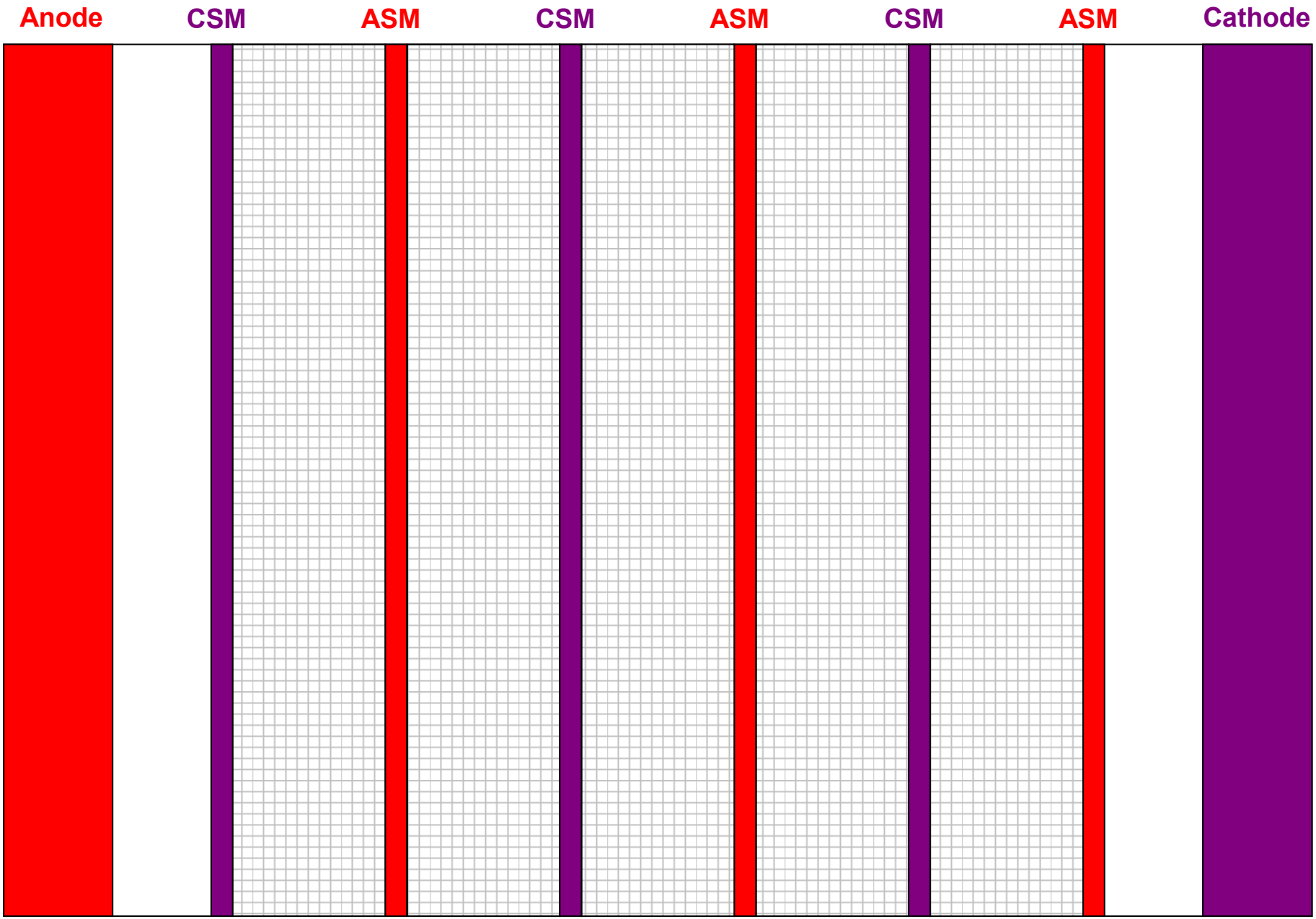
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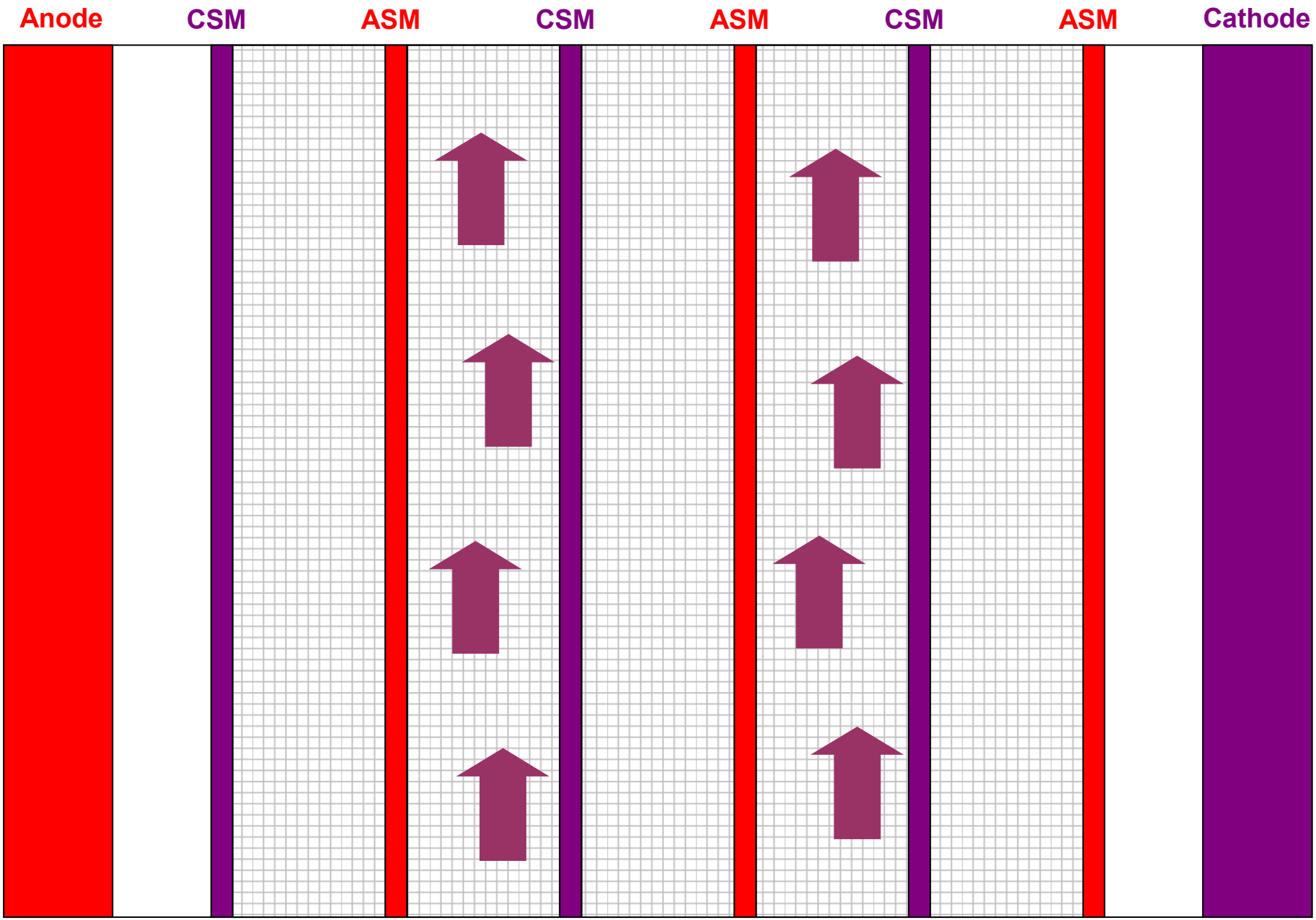
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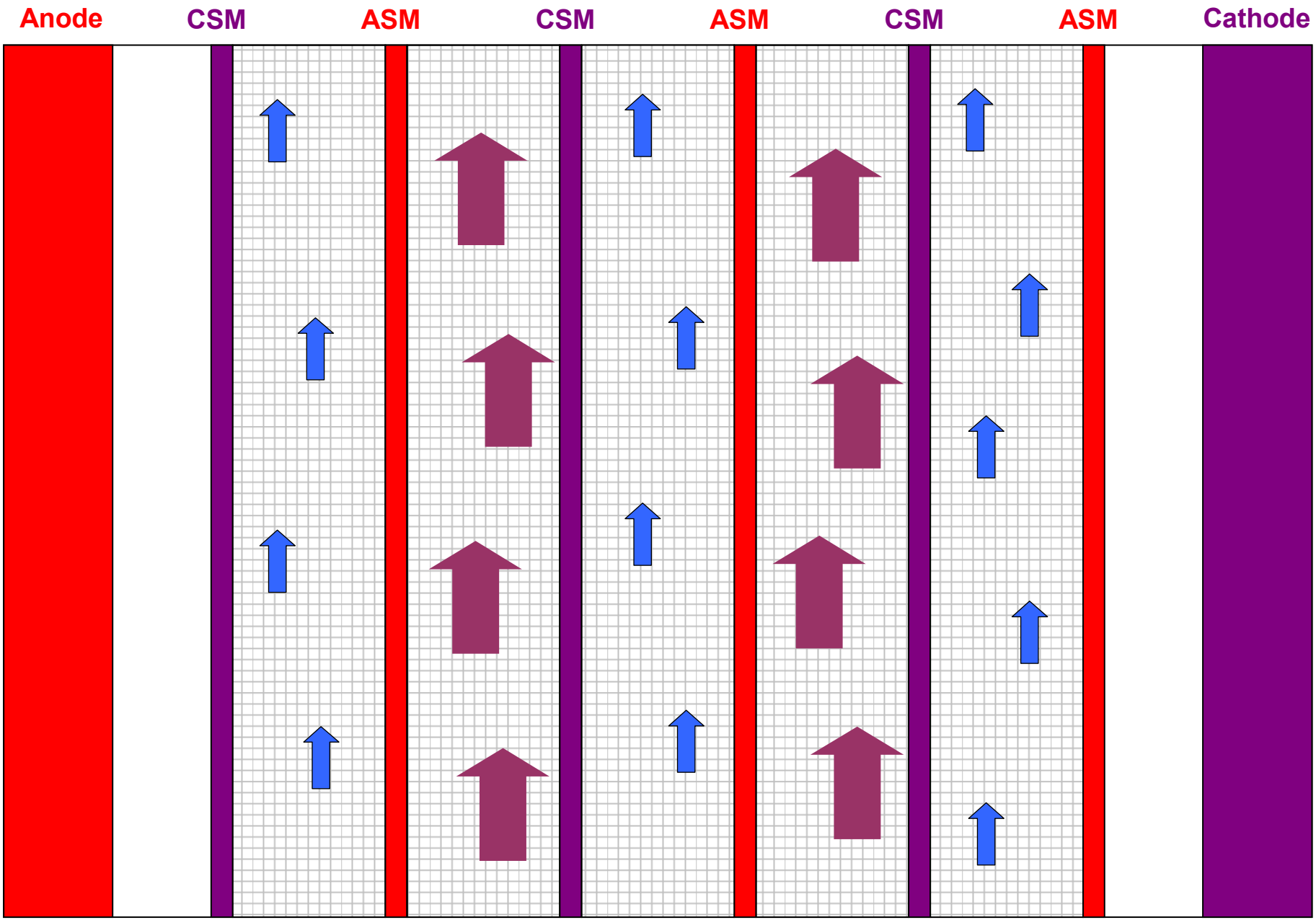
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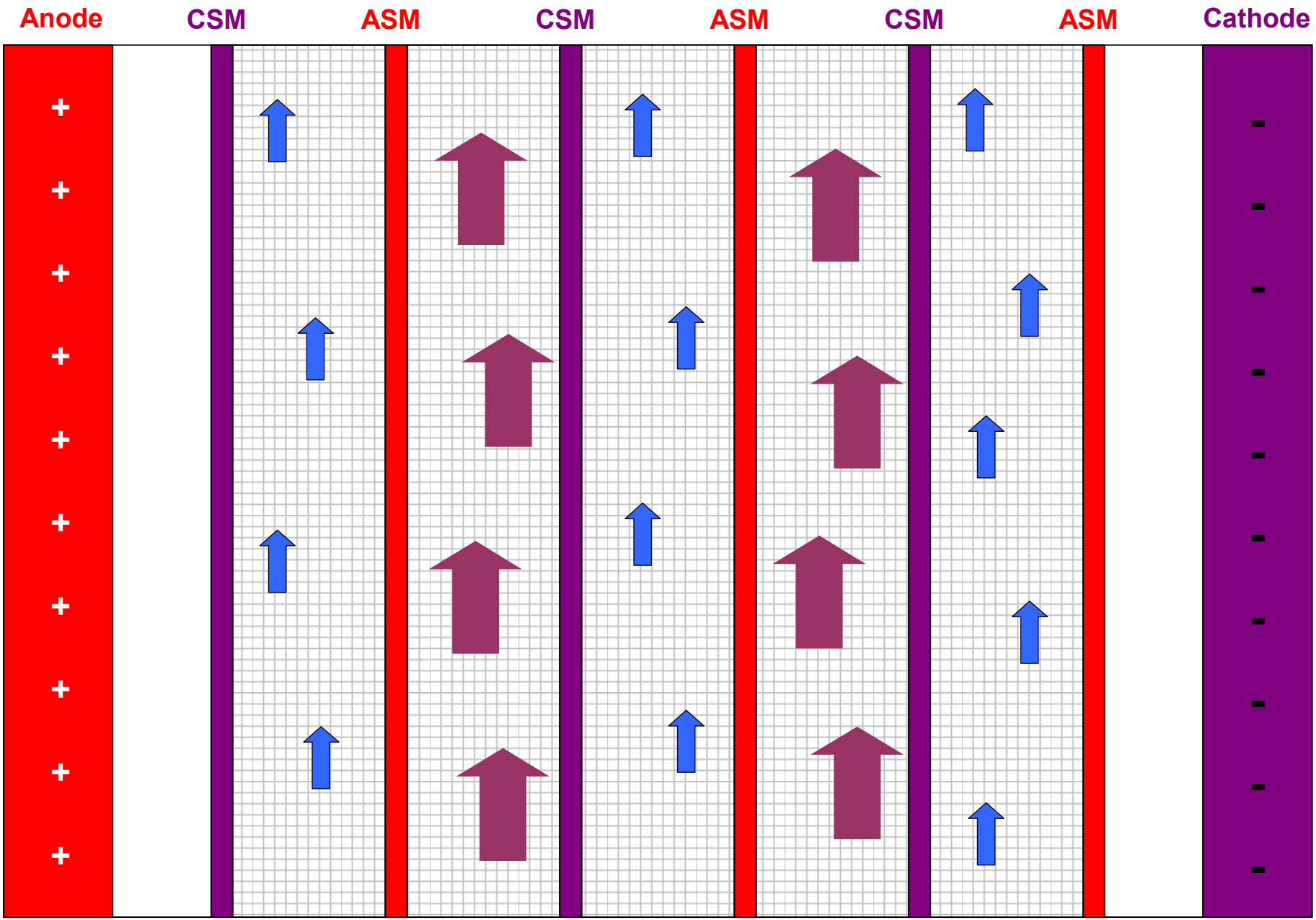
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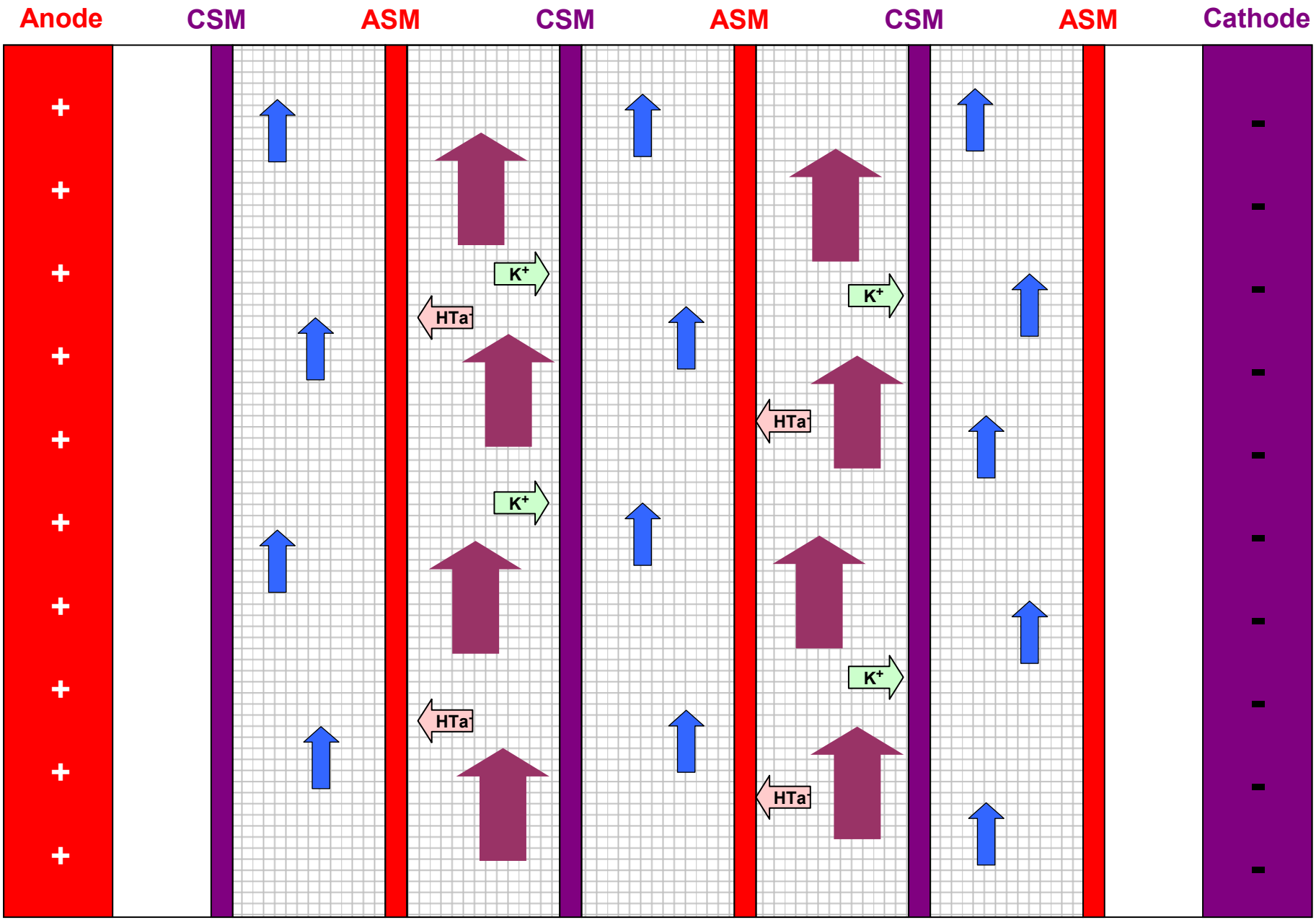
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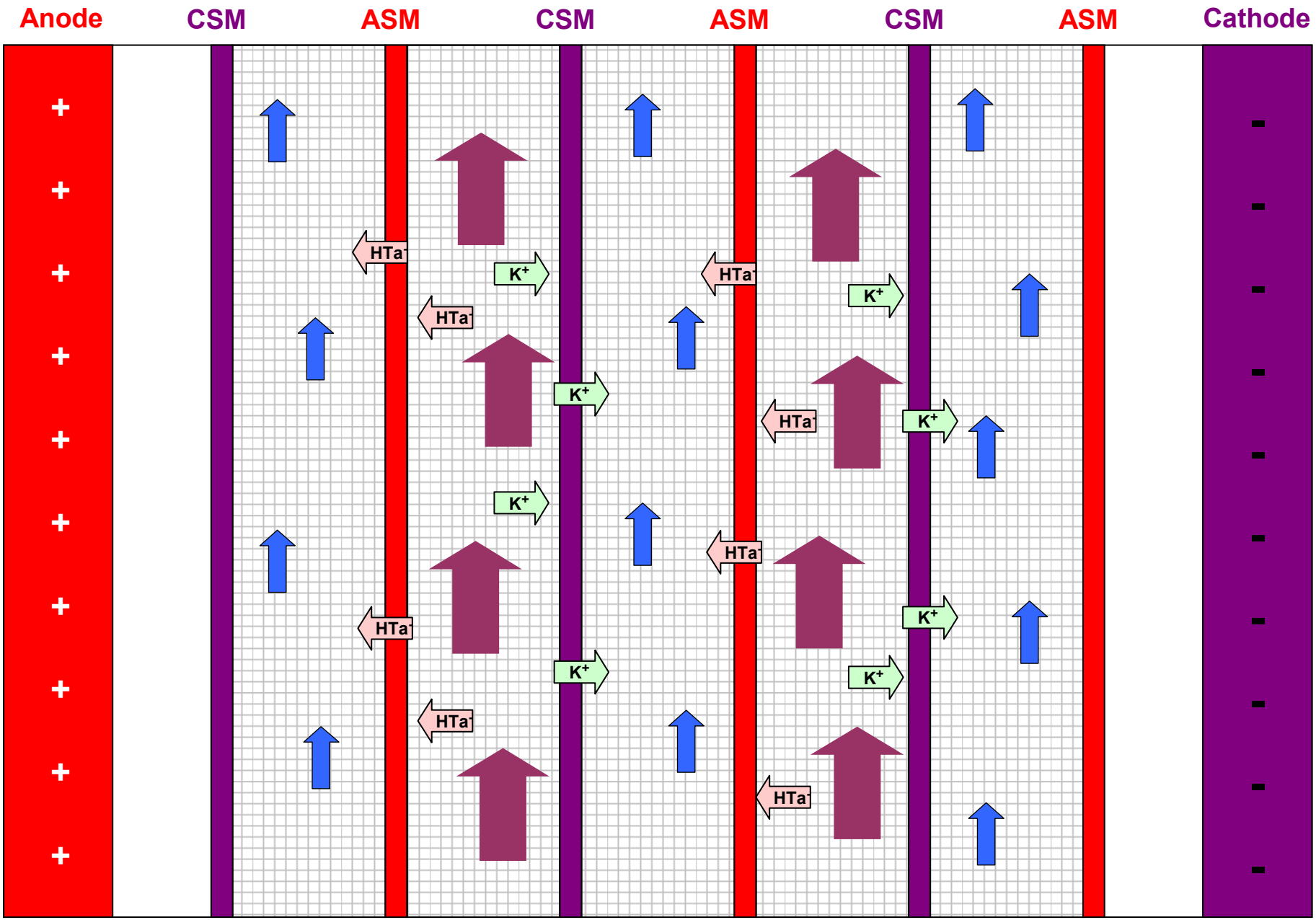
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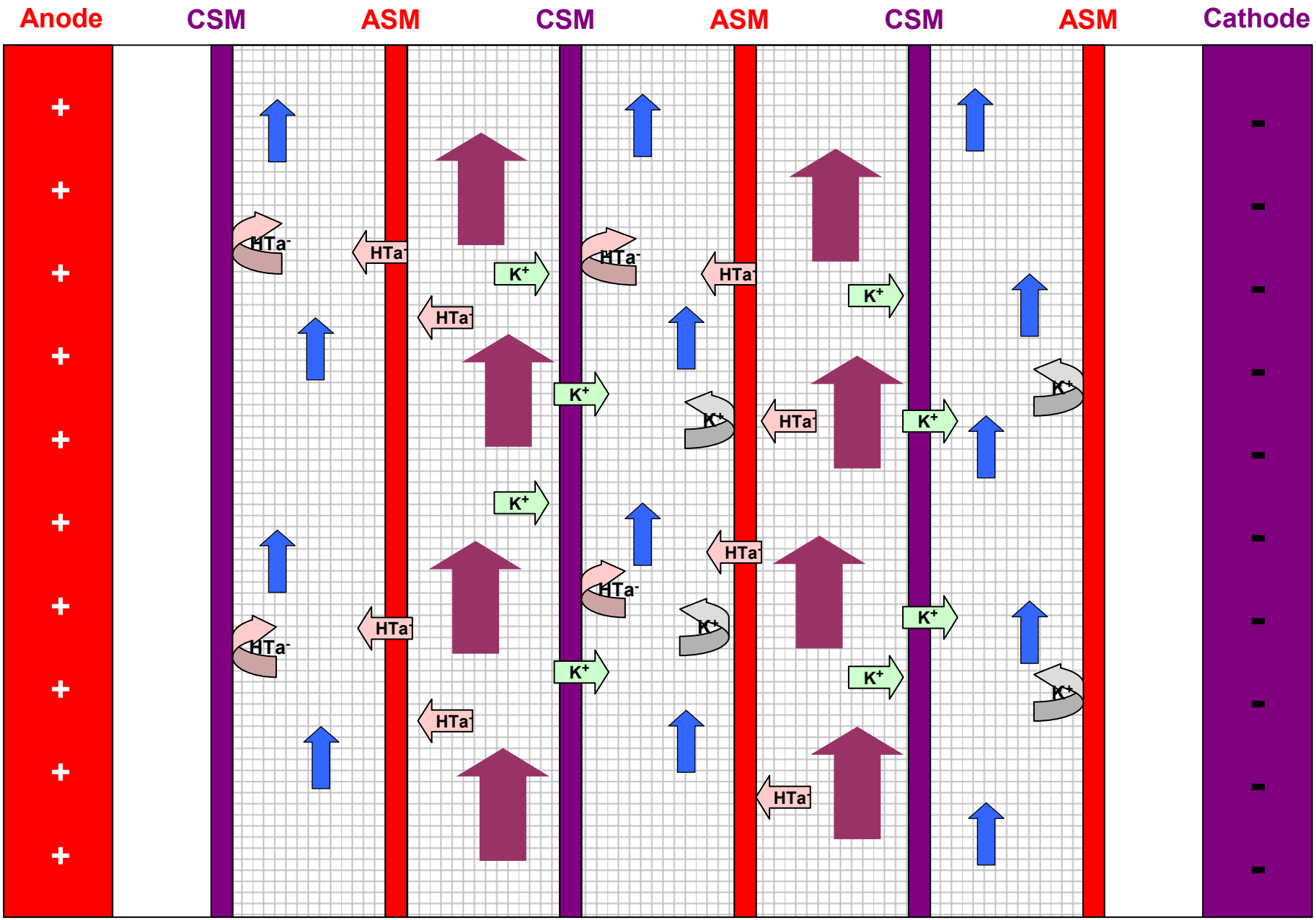
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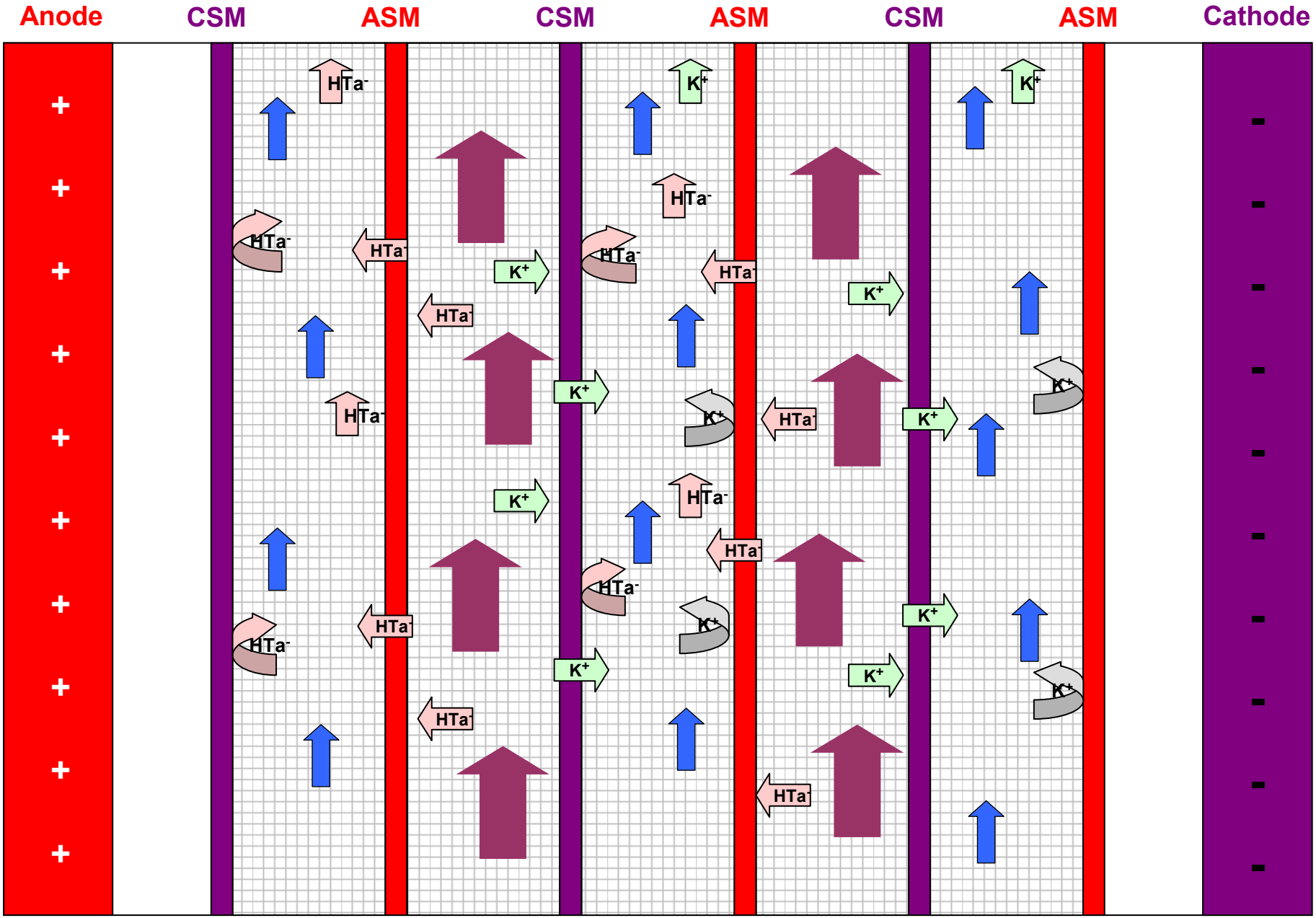
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Determining “cold stability”

- A misused and misunderstood term
- Depends on test used
- ED process is based on achieving a predetermined conductivity reduction
- Stabilab is used to determine required conductivity reduction
- Typically 7-30%

Stabilab

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Stabilab output

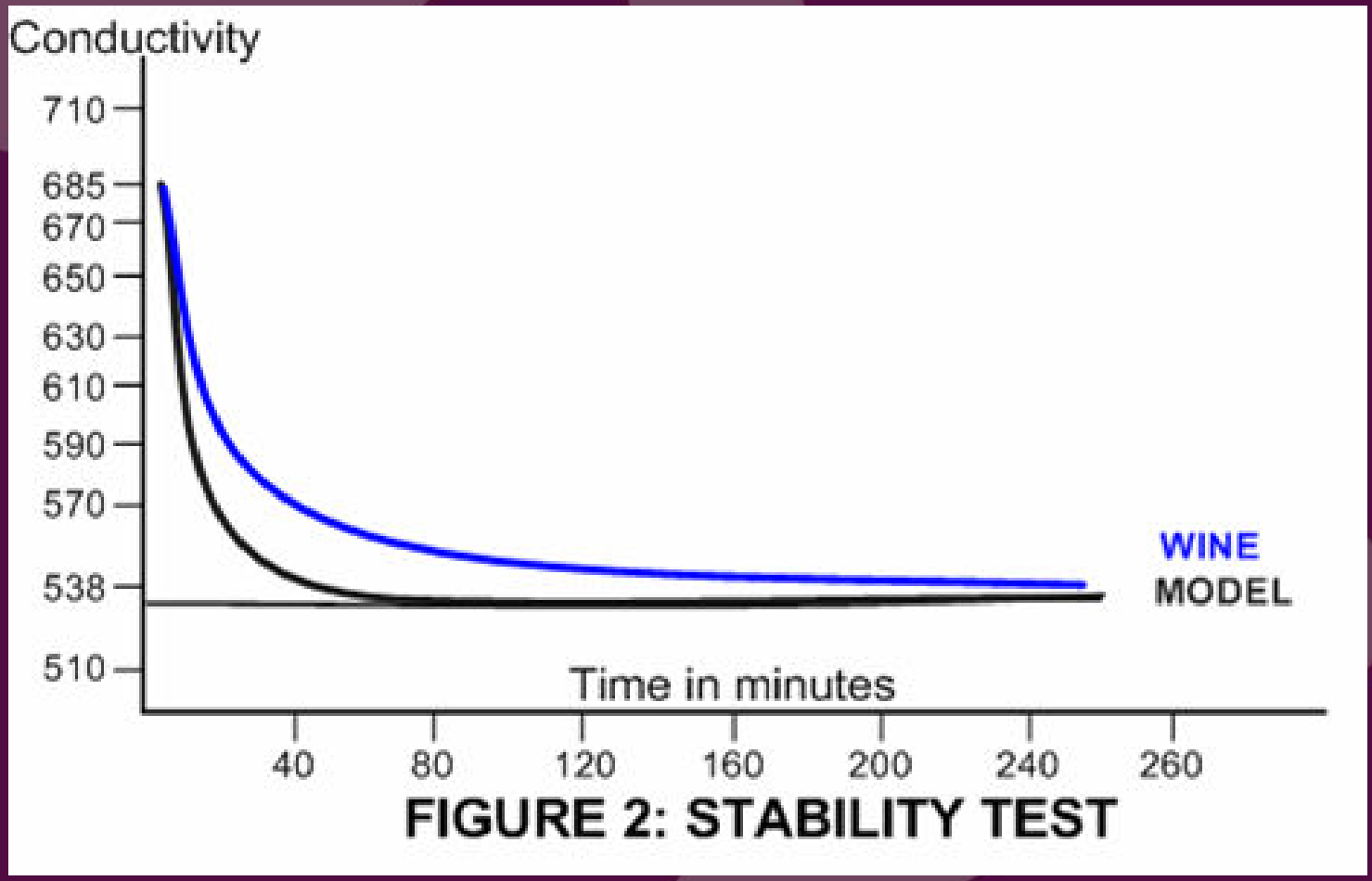

FIGURE 2: STABILITY TEST

Process control

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- Conductivity of sample measured over time in Stabilab
- 150ml of untreated wine is cooled to -4ºC with 600mg of potassium bitartrate (KHT) powder added (DIT Test)
- Required conductivity is determined by extrapolation of test results to a model
- Set point is programmed
- Machine monitors and controls the process
- Wine only passes to treated tank on reaching desired conductivity

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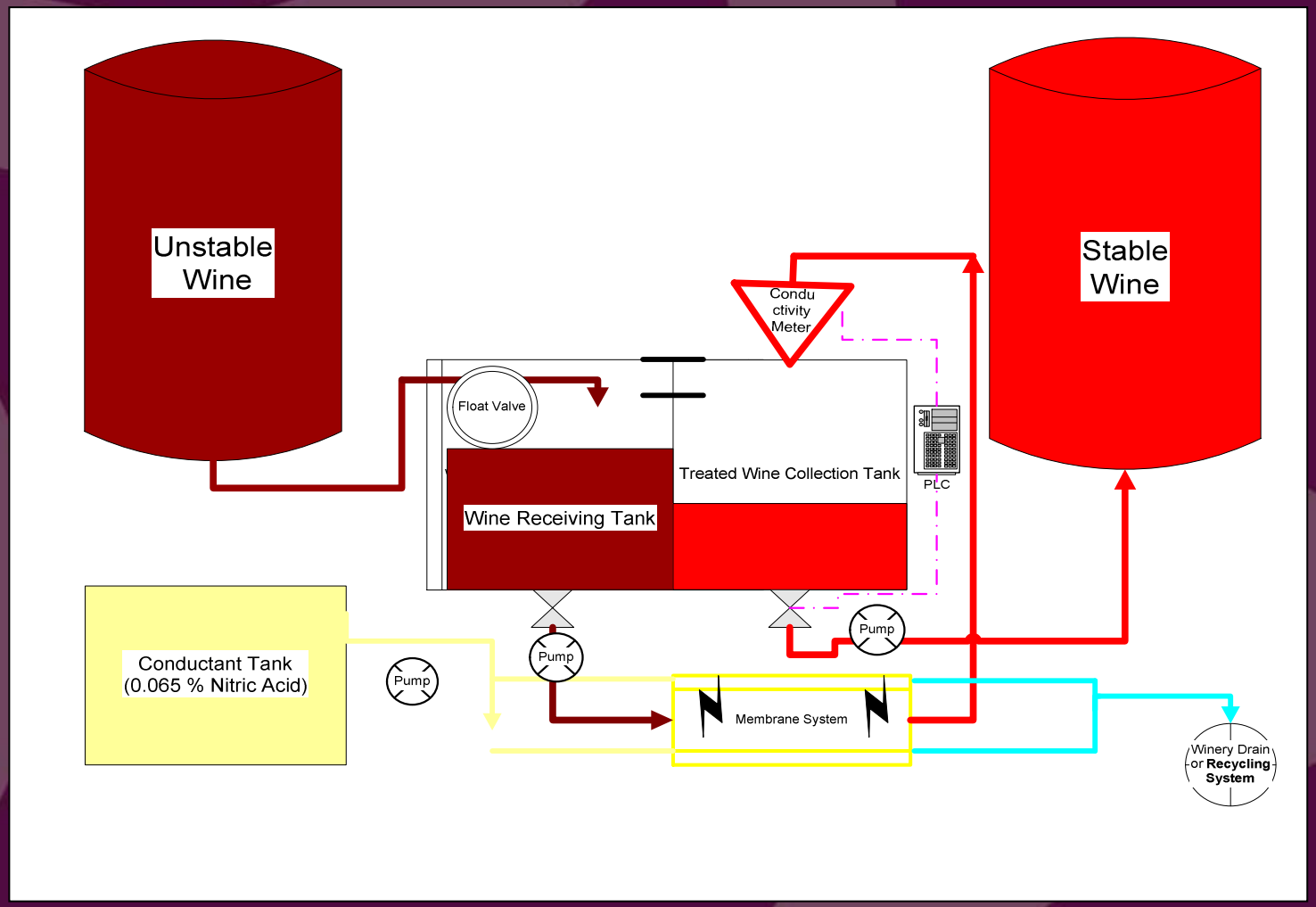
Process schematic



Stationary system (full automatic) 9,000 lph

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Pump skid, Control panel and stacks (2 x 1,500 lph)

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3,000 lph unit

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ED operating cycle

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- The unit works continuously for 10-12 hours between rinse cycles
- Rinse requires approximately one hour
- Cleaning cycle may be automated on stationary machines
- Utilises both sides of the selective membranes to improve service life
- Very small dead volume

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Why use it?

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- Rapid & continuous potassium, calcium and tartrate ion removal
- Reliable “stability” based on known conductivity reduction
- Wine quality – less impact compared to cold stabilisation
- No oxygen consumption, no wine loss, no aroma and flavour losses
- Reduced carbon footprint - Energy consumption about 80% lower than cold stabilisation
- Reduces sodium and chloride content
- Slightly lowers the pH (minimal change to acid)

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Costs/Savings of ED

- **Costs**
  - Capital / Depreciation
  - Membranes
  - Water
  - Consumables (HNO_3, NaOH, filter cartridges etc.)
  - Labour (2 hours a day)
- **Savings**
  - Electricity / Gas
  - No lees / wine loss (cf. 0.5-1.0% with cold stabilisation)
  - Potassium bitartrate, DE
  - Labour

“Hidden” Value

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- Prepare wine for bottling (blend; bentonite fine; filter)
- Then, one step, inline tartrate “stabilisation”
- Straight to bottling line
- No holding cold for several days
- No waiting to verify stability
- No re-warming
- No re-filtration
- No tartrate lees disposal
- Less tank cleaning required

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Membrane life and cost

- Typically 1,000 to 2,000 hours for anion membranes
- More for cation membranes
- Varies according to wine composition and operating conditions
- Big impact on operating cost
- Eurodia and their distributors offer a fixed price per litre to replace membranes and maintain system performance (MRP – Membrane Replacement Program)
- Typically ~AUD 1.5¢ per litre

By-product stream

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- Typically water is used at the rate of 12% of wine treated
- This leads to acidic waste stream of potassium, calcium, sodium cations and tartrate, chloride, nitrate anions
- An optional RO water recovery system can reduce water use and the waste stream by 50%

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Wine pre-clarification requirements

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- Typically wine should be filtered to pre-bottling standard
- Removes protective colloids which affect stability
- Reduces risk of membrane fouling
- (Bentonite and DE must be avoided)
- No further filtration needed

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Electricity Consumption – estimates:

- Cold Stabilisation – 18 kWh/kL of wine
- Electrodialysis – 3.2 kWh/kL of wine

  (source – California Energy Commission
  http://www.energy.ca.gov/pier/iaw/descriptions/500_02_001.html
  Note - depends on conductivity reduction required.)
- Recent French trials: 2kWh/kL

Salt removal initial results

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Sample	Conductivity (µs/cm)	pH	T.A. (g/l)	Acetic (g/l)	Ca (mg/l)	Na (mg/l)	K (mg/l)	Cl (mg/l)	ΔNaCl (%)
Control	2,998	3.41	5.9	0.44	64	184	1,199	457	
1	2,852	3.38	5.85	0.39	55	169	1,030	388	15%
2	2,478	3.36	5.88	0.38	57	167	928	295	35%
3	2,068	3.33	5.83	0.39	45	135	673	200	56%
4	1,840	3.30	5.81	0.38	53	118	577	152	67%

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pH adjustment with bipolar electrodialysis

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- Another ED technique, easily adaptable on standard ED stabilisation skids
- Reduces pH without acid addition
- Reduces potassium (replaces with H^+)
- May be used on juice
- By-product is a stream of KOH which can be used for winery cleaning

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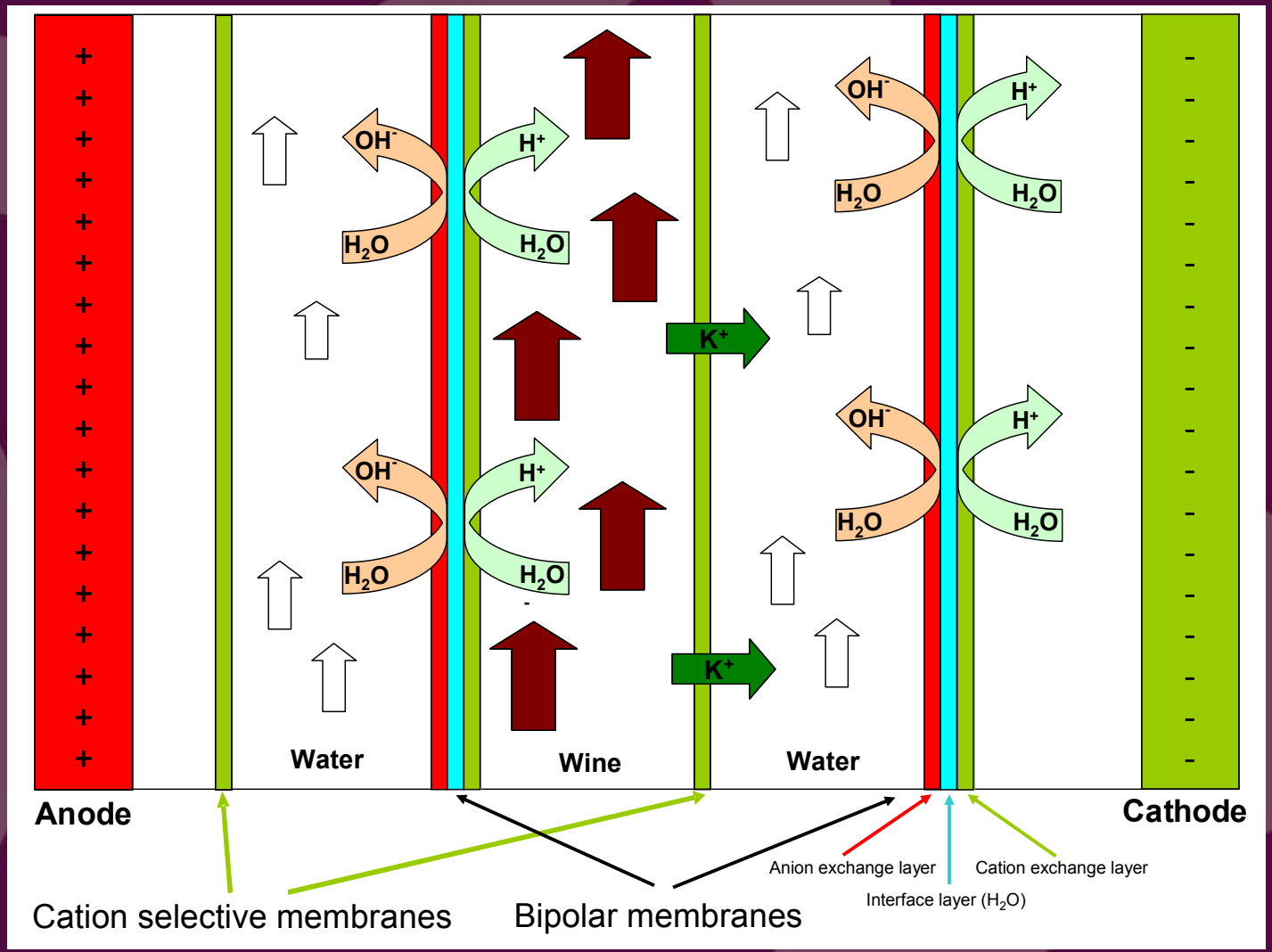
Bipolar electrodialysis



Summary - Why is ED a key to sustainability?

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- Just in time processing
- In comparison to cold stabilisation, the use of Electrodialysis for tartrate stabilisation will improve energy efficiencies and reduce carbon foot prints
- Wine loss is reduced
- Wine movement and labour is minimised
- ED is an improved wine processing technique that delivers reliable stability
- Overall water consumption is reduced
- For more information visit www.memstar.com.au or call 1300 MEMSTAR

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