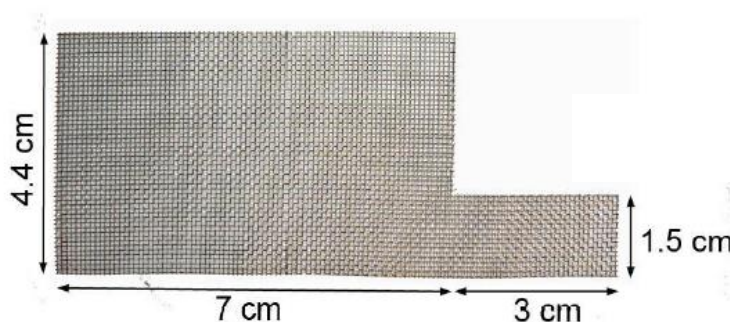


- 1) Look at video instructions: <https://youtu.be/fcLZ6dM-qIU?t=155>



- 2) Cut out 10 x 4.4 cm Al foil electrode(s). Polish this with sandpaper (it is optional, to increase initial power).
- 3) Also cut out 7.2 x 9.1 cm membrane and fold it around the Al foil – use double folded tissue paper.
- 4) Assemble one battery cell {cathode | membrane | anode | membrane | cathode } as shown in the video and wrap thread around the assembled battery. It must be packed tightly.
- 5) Check for short-circuit using a multimeter (there must be infinite resistance between the electrodes) (optional). If there is short-circuit, repack the electrodes.
- 6) Place the battery cell into the Tic-Tac container.
- 7) Connect motor or other load having ~ 0.3 - 2 Ohms resistance. Do not remove it before depletion of the battery (except for quick measurements), otherwise the battery may overheat. It is the nature of low purity aluminum; if zinc anode is used instead, battery can be disconnected and does not heat up.
- 8) Take 5 mL 2.5 - 10% KOH or NaOH solution into the syringe and wait until electrolyte dissolves and cools down a bit. 2.5% NaOH is safer to use. **Use safety goggles.**
- 9) Now add the hydroxide solution aiming at the top of the membrane. Race against competitor in a 5 m distance, typical race times are within 4 and 20 seconds. (Instead race, voltage vs current graph can be measured)
- 10) Depleted battery may be opened by cutting thread. Cathodes can be purified by soaking repeatedly in (distilled) water, and thereafter drying in air. Cathodes can be reused several times.

Some ideas for experimenting:

- 1) Using 2 multimeters (one as a voltmeter, another as an amperemeter) and a >2 W variable resistor (or following set of resistors: 1, 2.2, 4.7, 10, 18, 47, 470, 1000, and 566000 Ohms), measure dependence of voltage on current and plot it in a graph. Calculate power.
- 2) Test connecting battery cells in series or in parallel and measure voltage and current. Or use 5V stepup converter to charge your mobile phone with a single Al-air cell.
- 3) Purity of Al. High purity Al has lower corrosion and higher voltage than ordinary kitchen Al foil. Due to competing corrosion, voltage of low purity Al falls in time. Thus, pure Al is much better option for longer than a few minute car race experiments. To

further improve performance, corrosion inhibitor can be added, such as Na_2SnO_3 or ZnO .

- 4) Other metals, such as Zn or Al alloys can be tested as the anodes. Zn-air can be rechargeable. Mg-air works best with 3-10% NaCl electrolyte.
- 5) Electrolyte composition and concentration. Table salt (10% NaCl) solution can be tested – it is safer and does not corrode; however, gives much lower power.
- 6) Testing in oxygen medium instead of air environment.

Any questions? Ask in comment section of Al-air battery video at [youtube.com/chemicum](https://www.youtube.com/channel/chemicum) channel.

©Superaccu