



University of  
TORONTO

# ALUMINUM BLUE



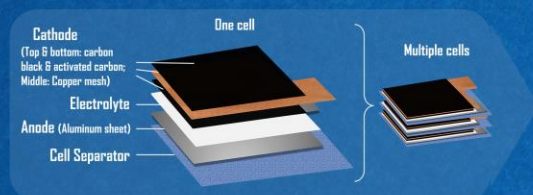
## Car Description

Aluminium Blue is an electric car powered by an aluminium-air battery, which drives a motor mounted on its acrylic chassis. It is stopped by the blue bottle reaction which turns off the motor by activating a colour sensor.

## Power Source

16 cells aluminium-air battery:

- Multiple layers of galvanic cells, each made up of aluminium anode and carbon-coated cathode
- KOH solution, sodium citrate and calcium hydroxide electrolyte
- A porous separator divides the two electrodes and provides a path for ions to flow
- Battery output at ~17-21V, 0.7A



Cell chemistry:

- Oxygen in the air reacts with aluminum to generate an electrical potential through the redox half-reactions below:



## Safety and the Environment

- PPE includes nitrile gloves, lab coat, and safety goggles
- Stopping mechanism reactants are used at very low concentrations
- Electrical connections between wires are soldered or use crimp connectors
- Velcro tape to hold containers in place

## Mechatronics

Chasis and containments:

- Custom acrylic cut chassis to optimize space use and reduce car weight
- Waterproof acrylic battery & 3D printed reaction containers

Circuitry:

- Voltage regulator used to set motor voltage input to 10V
- Two motor drivers paired with Arduino Uno to start the magnetic stirrer, the motor, and to take in signals from the color sensors to power off the motor



Annual Student Conference  
AIChE Chem-E-Car 2022 Finals

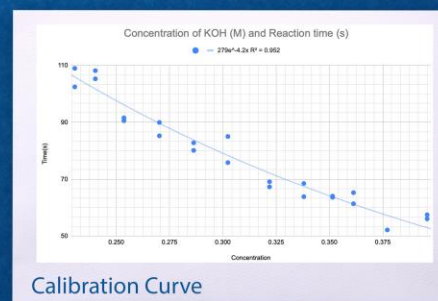
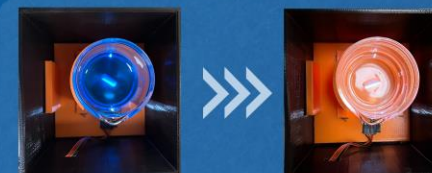
## Costing

	Fixed costs	Per run
Mech	\$253 CAD	-
Power	\$20 CAD	\$60 CAD
Reactions	\$16 CAD	\$1 CAD
Total	\$289 CAD	\$61 CAD

## Timing Reaction Mechanism

Blue bottle reaction:

- Reaction between aqueous KOH, dextrose, and methylene blue (MB)
- The oxidation of MB results in a color change in the solution
- Color change activates the sensor, thus triggering the stopping mechanism
- The sensor uses a first-derivative detection algorithm to reduce sensor drift error



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