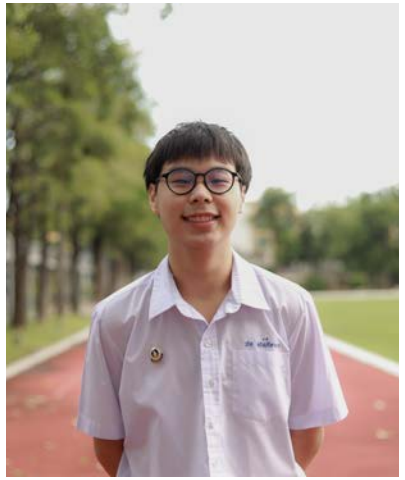
Innovation towards environmental sustainability: Development of alkaline polymer solid electrolyte for carbon dioxide battery



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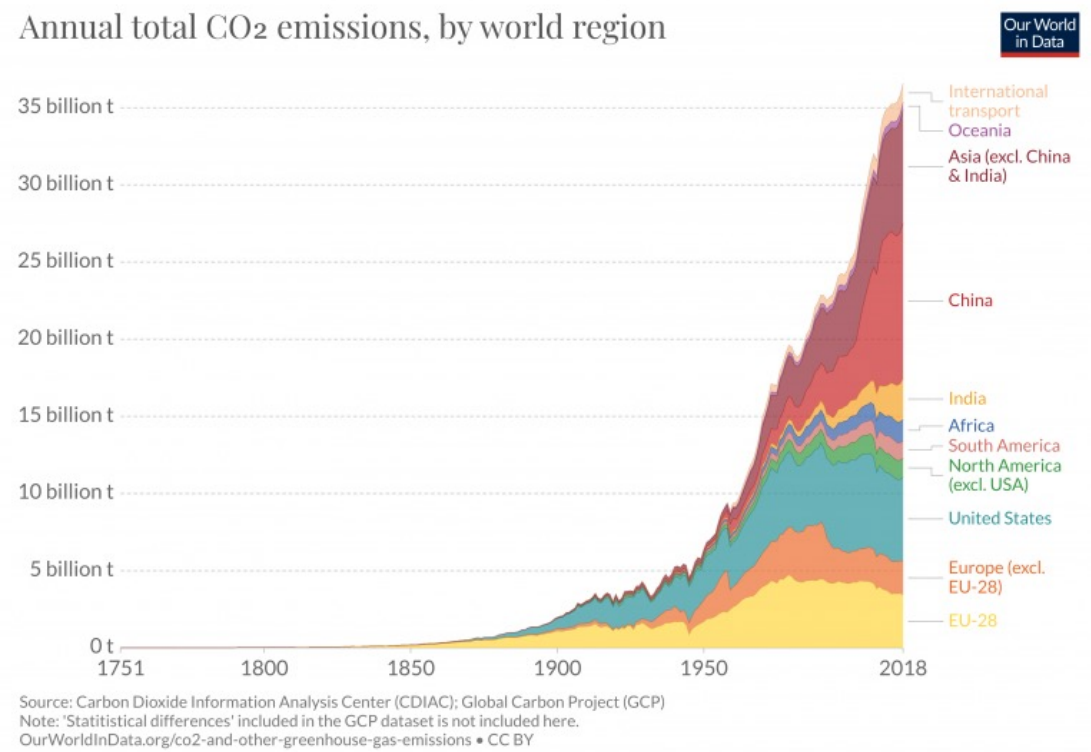
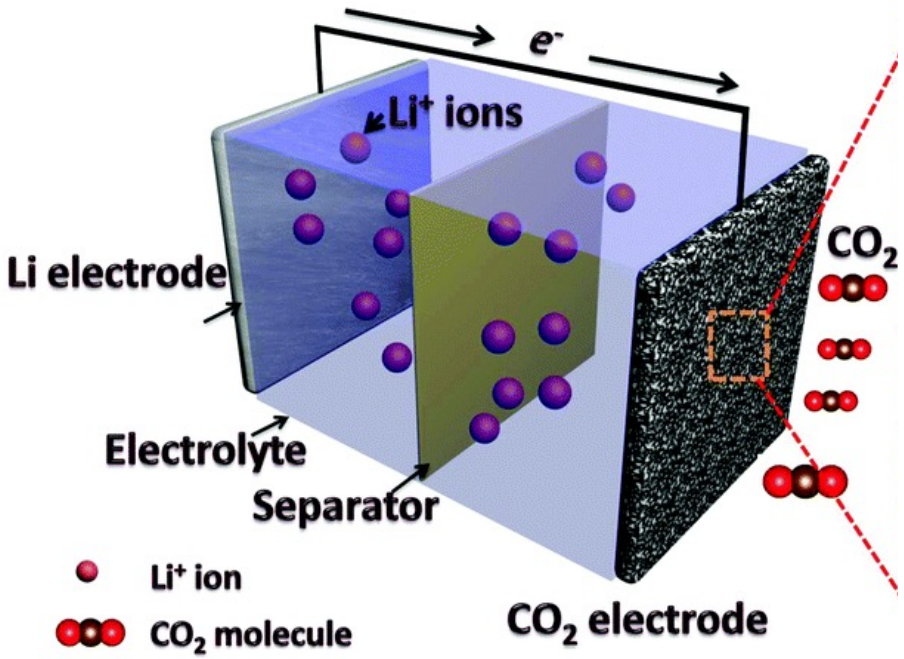
Introduction - CO_2 emissions



- Global Warming
  - Climate change
  - Ocean acidification
  - Wildlife extinction
  - Severe weather events
  - Higher sea levels

Introduction – CO_2-based electric generator

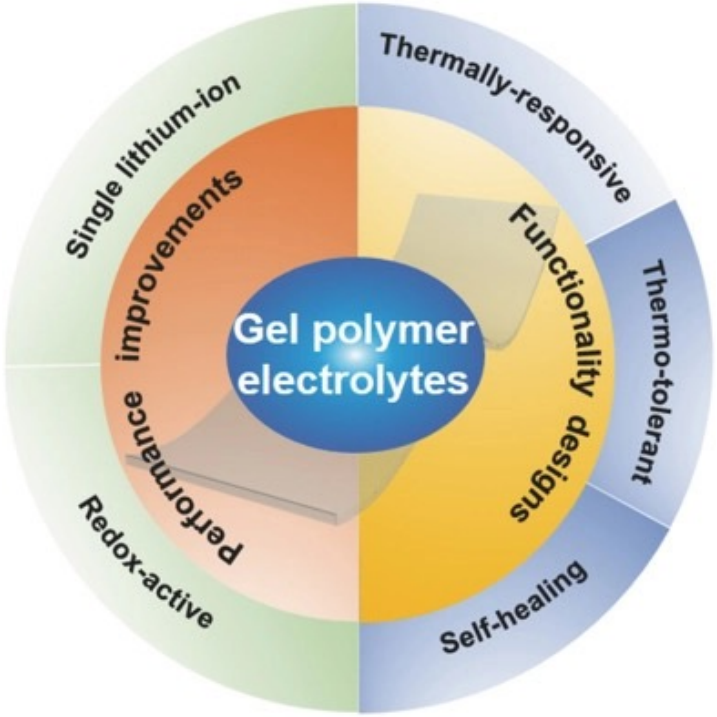


Roles of Electrolyte

- increase battery conductivity by promoting the movement of ions

https://www.lt2021.ru/category?name=lithium%20carbon%20dioxide%20battery

Introduction – GPE / objectives

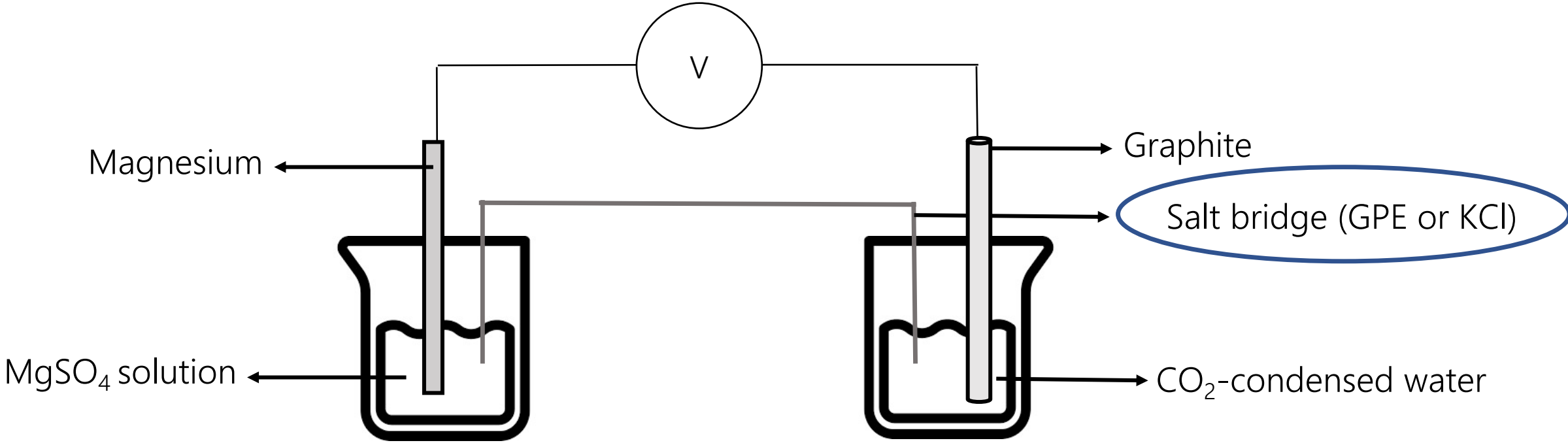


PVA-KOH GPE

- Replace currently organic electrolyte
- High ion conductivity
- More stable and safety
- Mechanical strength

https://onlinelibrary.wiley.com/doi/10.1002/aenm.201702184

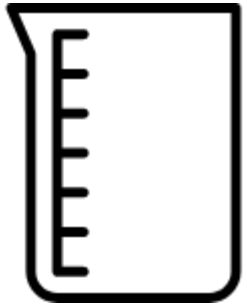
Methodology



$Mg \longrightarrow Mg^{2+} + 2e^-$

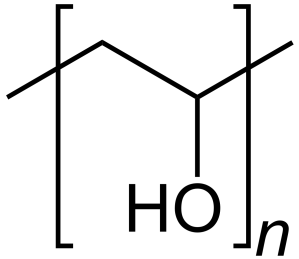
$2H^+ + 2e^- \longrightarrow H_2$

Methodology – Part 1: Synthesis of Polyvinyl alcohol–Potassium hydroxide GPE



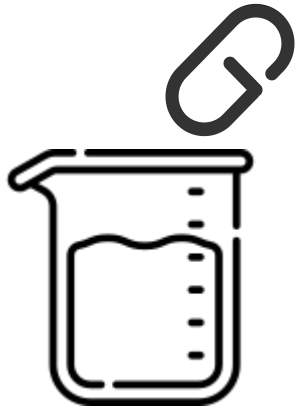
Prepare 300 ml. of water

Add 10 grams of KOH

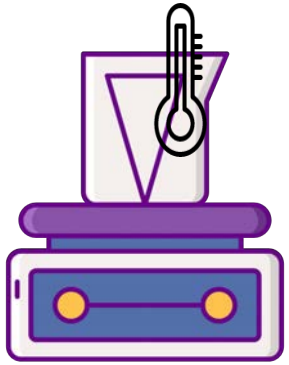


Add 10 grams of PVA

Methodology – Part 1: Synthesis of Polyvinyl alcohol–Potassium hydroxide GPE



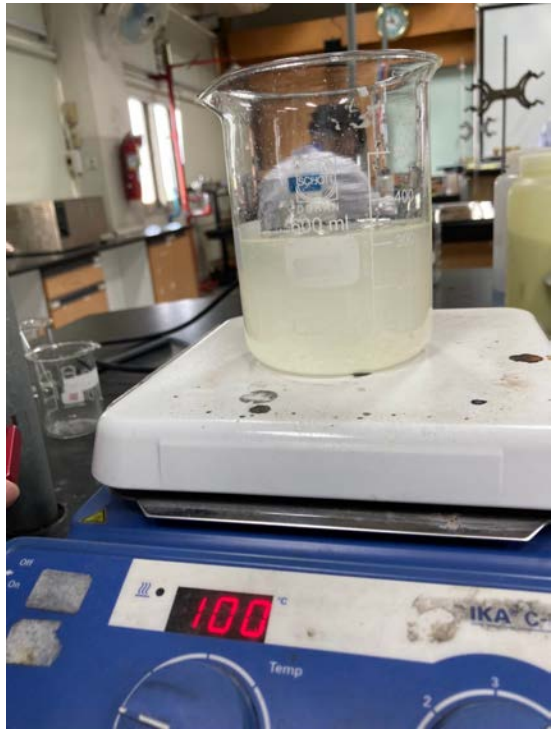
Put in magnetic stirrer



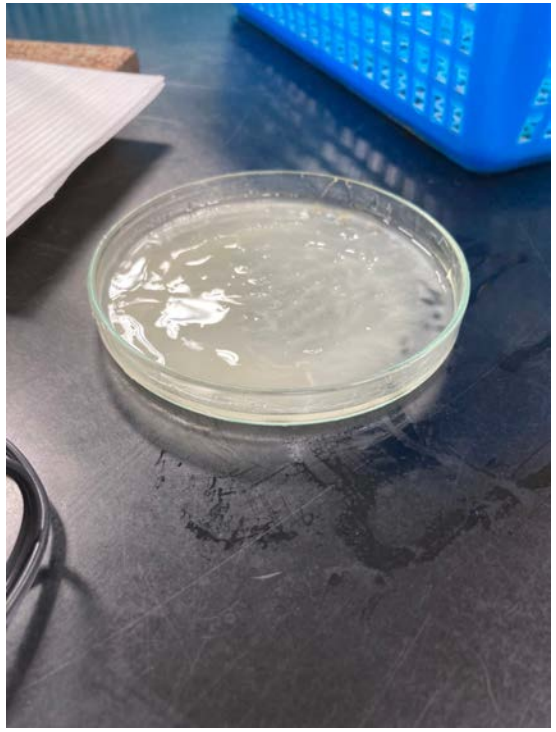
Heat and stir the mixture until it becomes 100°C

Wait until it is solidified

Methodology – Part 1: Synthesis of Polyvinyl alcohol–Potassium hydroxide GPE



PVA, KOH and water mixture



Synthesized electrolyte

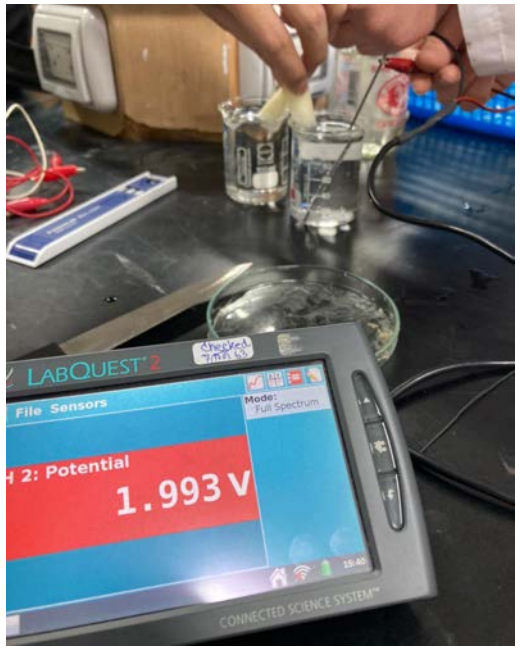
Methodology - Part 2: Examining GPE

Battery Prototype

- Magnesium as Anode
  - Good reductant (high E^0)
  - prevalent
  - Low price
- Graphite as Cathode
  - Stable
  - Act as activated carbon

Results and Analysis of Part 2

KCl as a salt bridge



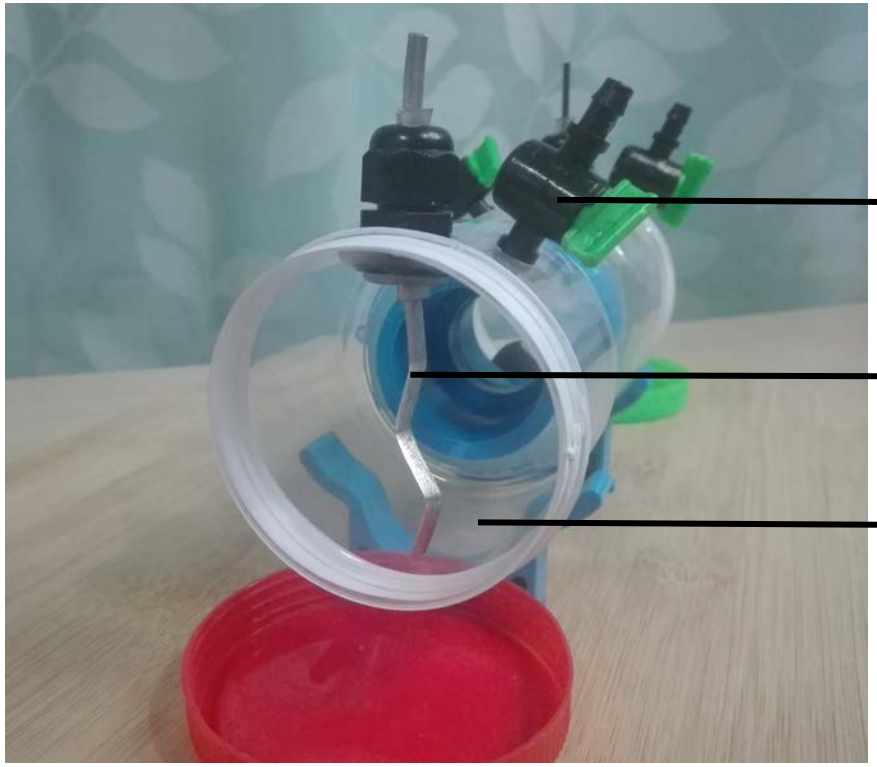
Synthesized GPE

Results and Analysis of Part 2

Salt bridge	Voltage (V)				
	1	2	3	average	Standard deviation
KCl	1.744	1.799	1.743	1.762	0.0320
PVA – KOH GPE	1.990	1.993	1.986	1.990	0.0035

Carbon dioxide electric generator model

Carbon dioxide electric generator model



Hydrogen gas Output Valves

Magnesium Electrode

$MgSO_4$ 1.0 M Cavity

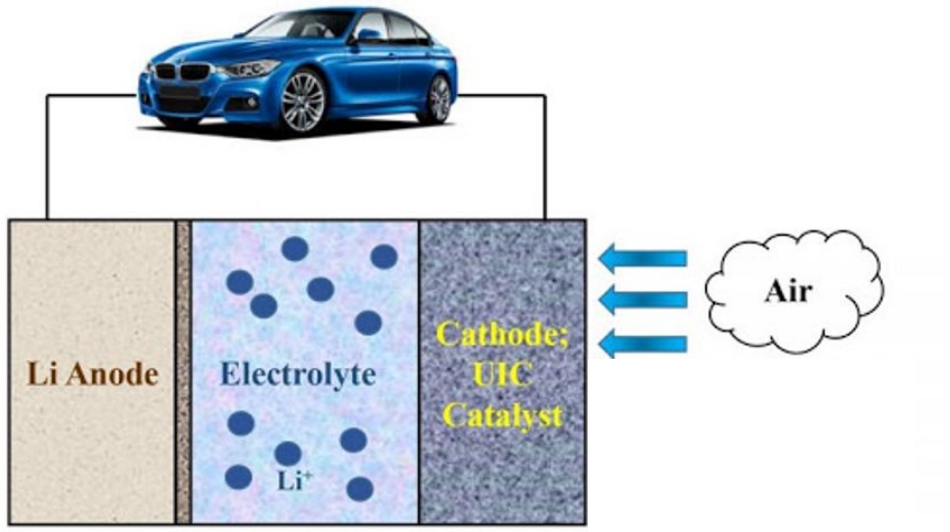
Carbon dioxide electric generator model

Carbon dioxide electric generator model

PVA – KOH GPE

- The solid electrolyte gel can work efficiently with CO_2-based battery
- Electrical voltage from prototype : up to 2.00 V

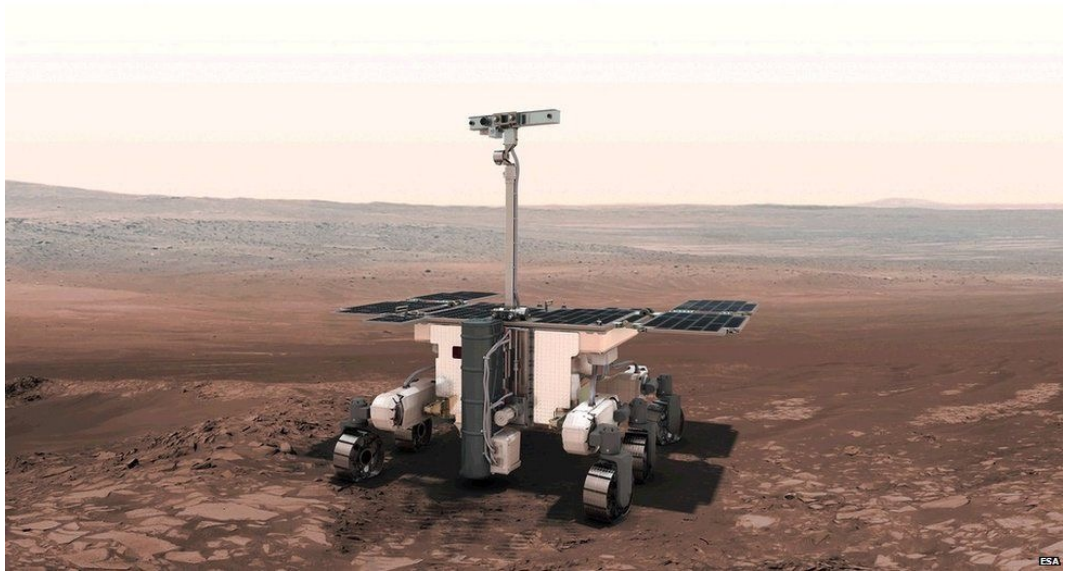
Practical Application



- Our gel electrolyte can be applied in CO_2 system batteries
- The batteries can be attached vehicles or used in industry

http://cafe.foundation/blog/charging-carbon-dioxide-batteries-and-clearing-the-air/

Practical Application



- The atmosphere of Mars is primarily composed of carbon dioxide.
- Using Carbon dioxide-based battery can generate the energy when a spacecraft is close to the surface.

https://www.bbc.com/news/science-environment-55229999

Reference

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