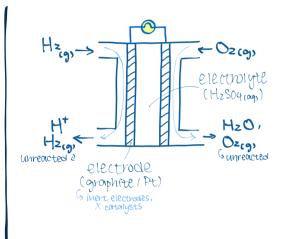
# 1 Principle

- Combustion of fuel (fuel + Oz -> ...)
- hazard warning labels: flammable + oxidizing fuel(燃料)
- advantages
- 5 eg. for hydrogen fuel cells
- > environmentally friendly as water is produced
- > high energy efficiency.
- 女問意 electrolyte 方 acidic/alkaline medium
  - > acidic: OH- TO H+
  - > alkaline: H+ to OH-
  - > Carbonate  $(CO3^2)$ : 转版 acidic medium  $(OH^- 1) > H^+)$ , 再加  $CO3^{2-} (2H^+ + CO3^2) \rightarrow CO2 + H_2O)$

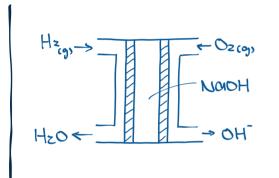
## 2 Examples

#### HYDROGEN FUEL CELLS, ACIDIC MEDIUM



- A: Hz > 2H++2e Colordic medium 二不用变
- > : acidic medium : OH TISHT C: 4H++ Oz + 2H2O+4e->40H-+4H+ C> 4e + 4H + O≥ → ≥H≥O
- $\Rightarrow$   $2H_2 + O_2 \Rightarrow 2H_2O$
- 5 tue: environmentally friendly as water is produced high energy efficiency -ve: explosive (: Hz)

## HYDROGEN FUEL CELLS, ALKALINE MEDIUM.

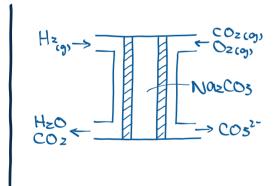


- A: 20H+Hz > 2H++2e+20H 6 2017 + H2 -> 2H20+20
- C: O≥ + 2H2O + 4e → 40H

 $\Rightarrow$   $2H_2 + O_2 \rightarrow 2H_2O$ 

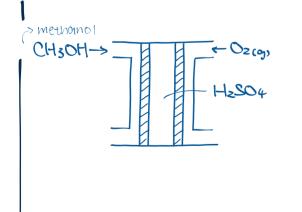
5 tue/-ve same as acidic medium cell

#### HYDROGEN FUEL CELLS, CARBONATE MEDIUM -



- A: CO32+ Hz > 2H++2e+ CO32 G CO32-+H2 → CO2+H2O+20-
- 一步使做 a cidic medium C: 4H++ Oz + 2H2O+4e->40H-+4H+ C> 2 CO32+ Oz + 4H+ + 4e- -> 2H2O + 2CO32-GO2+2CO2+2H2O+4e → 2H2O+2CO32  $6 + 200_2 + 4e^- \rightarrow 200_3^{2-}$
- => 2Hz + O≥ > 2H≥0
- > tue/-ve same as acidic medium cell

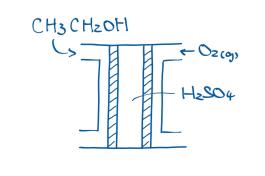
## OTHER FUEL CELLS



C: 4H++ 02 + 2H2O+4e->40H-+4H+ C> 4e + 4H + O≥ → ≥H≥O

> full eqn: CH5OH + O2 → H2O+CO2

- A: H20+ CH30H -> CO2+6H+60-
- 4e + 4H+ 02 -> 2H20 +) H2O+CH3OH -> CO2+6H+60 2CH3OH+302→4H2O+2CO2



- C: 4H++ Oz + 2H2O+4e->40H-+4H+ C> 4e + 4H + O≥ → ≥H≥O
- A: 3H2O+ CH3CH2OH -> 2CO2 + 12H+12e
- 4e + 4H+ 02 -> 2H20
- +) 3H2O+ CH3CH2OH -> 2CO2+12H++ 12e CH3CH2OH+302→3H2O+2CO2

# For hydrogen fuel cells

- overall egn.
  - > 无论如何也是 2Hz + Oz -> 2HzO
- Acidic medium
  - > Anode: H+, Cathode: H20
- Alkolline medium
  - > Anode: 1-120, conthode: OH