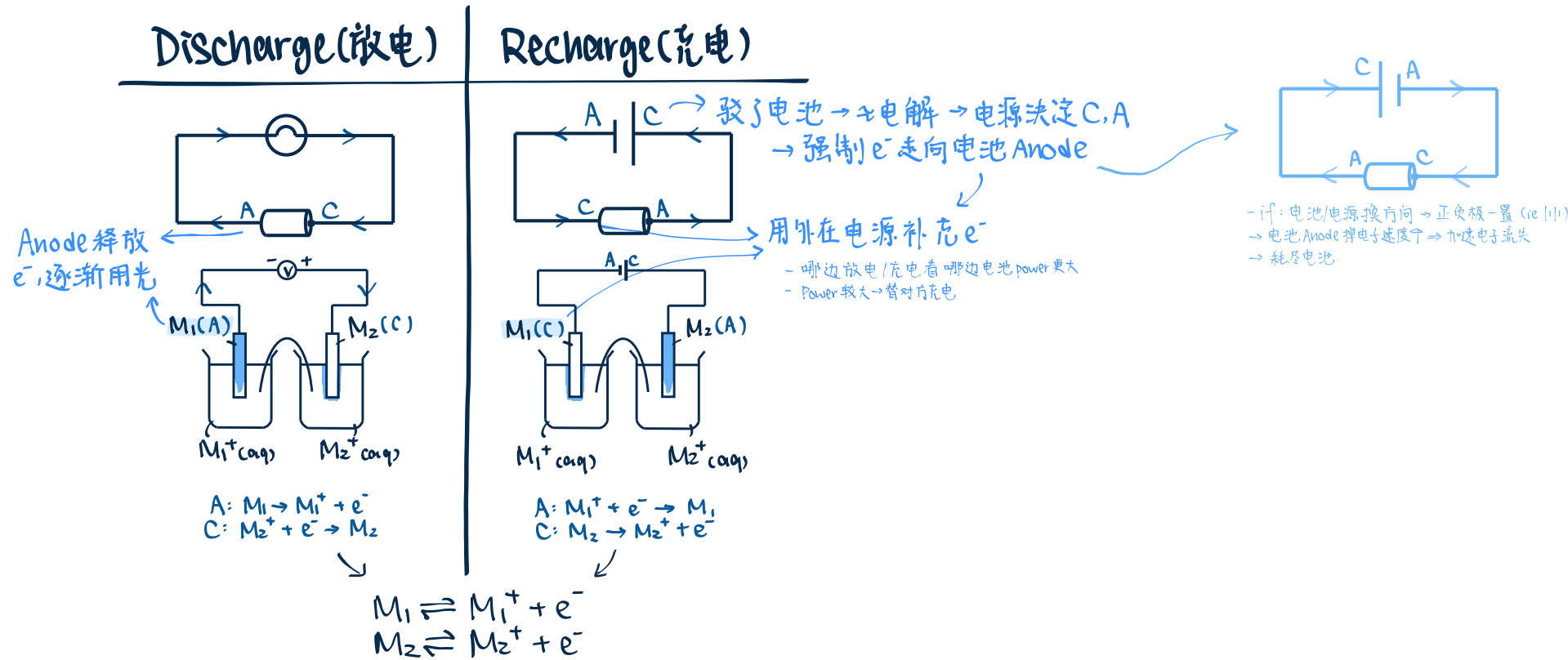


Secondary cells

1 Secondary cells

- ✓ recharged → reversible reactions at anode & cathode



LEAD-ACID BATTERY CELL

<p>$H_2SO_4(aq)$</p> <p>↳ $PbSO_4$ 积聚在 Cathode, anode</p>	$Pb + PbO_2 + 2H_2SO_4 \rightleftharpoons 2PbSO_4 + 2H_2O$ <p>When discharging:</p> <p>草稿</p> <p>R.A.: $SO_4^{2-} + Pb \rightarrow PbSO_4 + 2e^-$ (in H_2SO_4 or $NaOH$ medium)</p> <p>O.A.: $SO_4^{2-} + PbO_2 \rightarrow PbSO_4$ \downarrow 加水 $SO_4^{2-} + PbO_2 \rightarrow PbSO_4 + 2H_2O$ \downarrow 加水 + H^+, 电子 $2e^- + 4H^+ + SO_4^{2-} + PbO_2 \rightarrow PbSO_4 + 2H_2O$ (in acidic medium, 不用变 H^+)</p> <p>→ C(C): $2e^- + 4H^+ + SO_4^{2-} + PbO_2 \rightarrow PbSO_4 + 2H_2O$ A(Pb): $SO_4^{2-} + Pb \rightarrow PbSO_4 + 2e^-$</p>
<p>$H_2SO_4(aq)$</p> <p>↳ $PbSO_4$ 变回 SO_4^{2-} 进入溶液</p>	<p>When recharging:</p> <p>→ C(C): $PbSO_4 + 2H_2O \rightarrow 2e^- + 4H^+ + SO_4^{2-} + PbO_2$ A(Pb): $PbSO_4 + 2e^- \rightarrow SO_4^{2-} + Pb$</p> <ol style="list-style-type: none"> $PbSO_4 \rightarrow SO_4^{2-}$ 不一定有 100% yield → 电池容量随时间减少 充电 = 电解 $H_2SO_4(aq)$ = 电解水 → 制造 H_2, O_2 → H_2, O_2: insulator → ↑ resistance → $2H_2 + O_2 + H_2O$: exothermic → 充电时电池发热 → 若 1% excessive high voltage 充电 > produce large amt. of H_2, O_2 + heat > sudden expansion of large amt. of gas → explosion

NICKEL - CADMIUM CELL

<p>$NaOH(aq)$</p>	$2NiOOH + Cd + 2H_2O \rightleftharpoons 2Ni(OH)_2 + Cd(OH)_2$ <p>When discharging:</p> <p>草稿</p> <p>A(Cd): $2OH^- + Cd \rightarrow Cd(OH)_2 + 2e^-$ (金属一定是 Anode, Cd X Bipol metal → $Cd(OH)_2$ 不溶于水 → 不能拆)</p> <p>C(C): $OH^- + NiOOH \rightarrow Ni(OH)_2$ \downarrow 加水 $OH^- + NiOOH \rightarrow Ni(OH)_2 + H_2O$ \downarrow 加水 + H^+, 电子 $e^- + H^+ + H_2O + NiOOH \rightarrow Ni(OH)_2 + H_2O$ \downarrow NaOH medium: H^+ 加 OH^- $e^- + H_2O + NiOOH \rightarrow Ni(OH)_2 + OH^-$</p> <p>验证:</p> <p>$2OH^- + Cd \rightarrow Cd(OH)_2 + 2e^-$ +) $2e^- + 2H_2O + 2NiOOH \rightarrow 2Ni(OH)_2 + 2OH^-$ ----- $2NiOOH + Cd + H_2O \rightarrow 2Ni(OH)_2 + Cd(OH)_2$ ↳ 与原本的 full eqn. 一样</p> <p>→ C(C): $e^- + H_2O + NiOOH \rightarrow Ni(OH)_2 + OH^-$ A(Cd): $2OH^- + Cd \rightarrow Cd(OH)_2 + 2e^-$</p>
<p>$NaOH(aq)$</p>	<p>When recharging:</p> <p>= reverse discharging eqn.</p> <p>→ C(C): $Ni(OH)_2 + OH^- \rightarrow e^- + H_2O + NiOOH$ A(Cd): $Cd(OH)_2 + 2e^- \rightarrow 2OH^- + Cd$</p>

(DIS)ADVANTAGES

Nickel cadmium cell	Lead acid battery cell
✓ recharged → used for multiple cycles	
- leaks transition metal (Ni/Pb), metal forms compound which is toxic	