

Reakcije u hemijskim izvorima struje

Predavanje 10, 23.03.2020.

Udžbenik: S. Mentus, Elektrohemija, 2008, strane 120-126

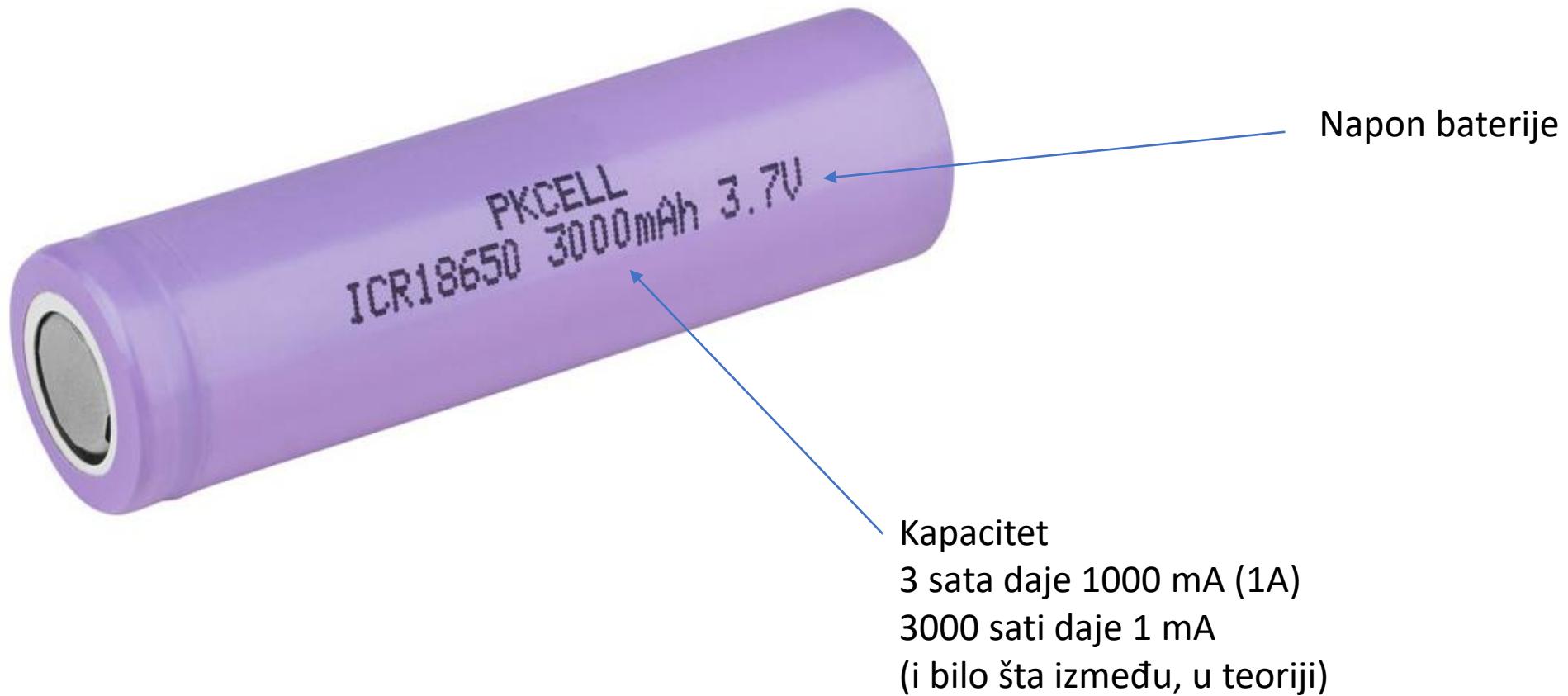
(NAPOMENA: Za ispit dolaze u obzir samo izvori koji su obrađeni u udžbeniku)

Hemijski izvori struje – opšte osobine

Galvanski element koji služe kao prenosivi izvori električne energije

- niska cena,
- najmanje moguće zagađivanje životne sredine,
- mala gustina,
- veliki napon otvorenog kola,
- brze elektrodne reakcije,
- veliki stepen iskorišćenja aktivnih materijala,
- mali stepen samopražnjenja (međusobnog reagovanja aktivnih materijala).

Hemijjski izvori struje – opšte osobine



Hemijjski izvori struje – opšte osobine

tesla car weight of batteries



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1,200 lb

The 85 kWh battery pack weighs 1,200 lb (**540 kg**) and contains 7,104 lithium-ion battery cells in 16 modules wired in series (14 in the flat section and two stacked on the front).



en.wikipedia.org › wiki › Tesla_Model_S ▾

[Tesla Model S - Wikipedia](#)

Gustine snage 85000 Wh / 540 kg

= 157 Wh/kg

Jedna Li-ion ćelija 12 Wh

(ako radi na 4 V onda ima 3000 mAh)

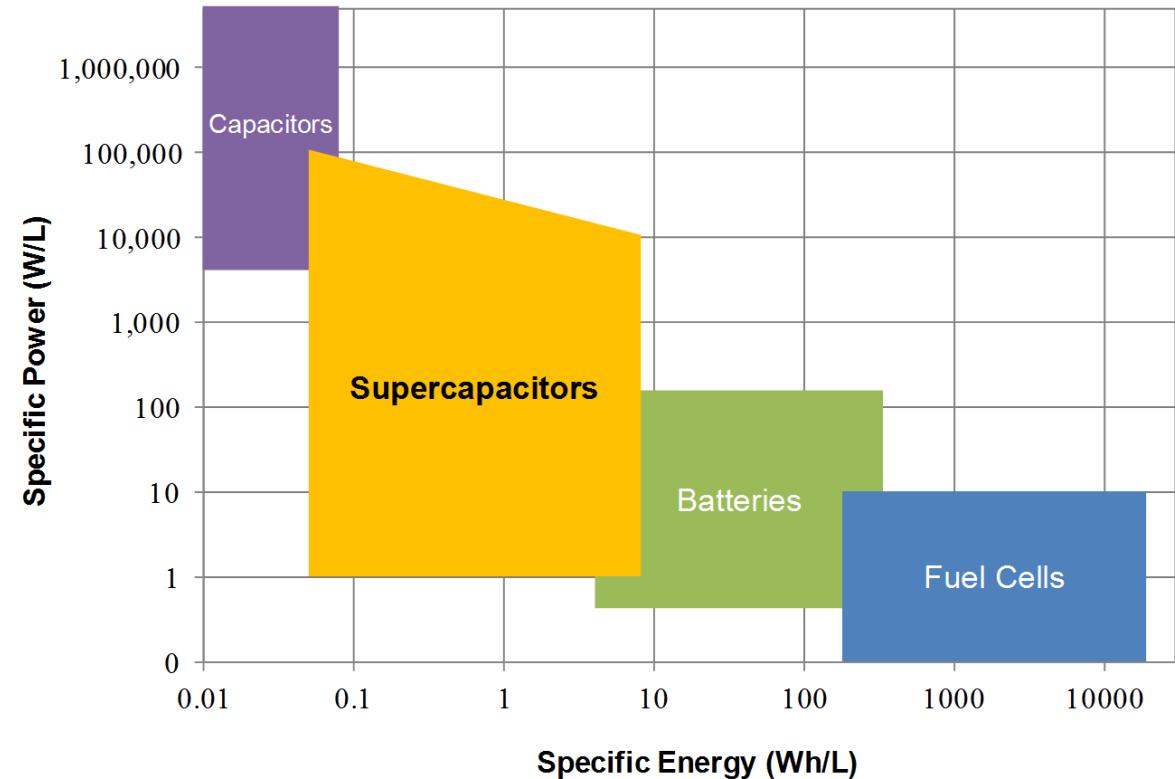
Konverzija **Wh u mAh**

Formula je **(Wh)*1000/(V) =(mAh)**.

1.5**Wh** baterija sa nominalnih 5V, snaga je **1.5Wh * 1000 / 5V = 300mAh.**

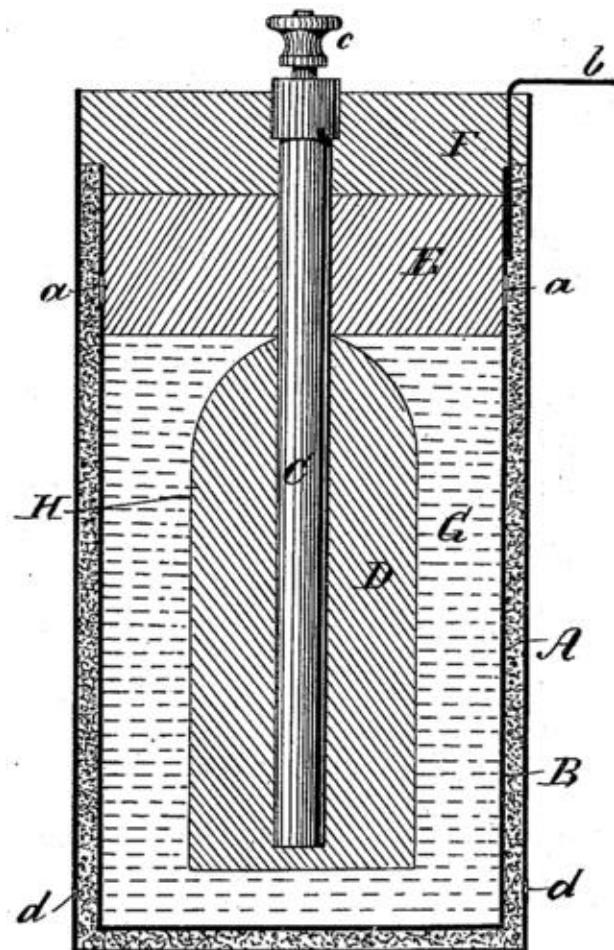
Hemografski izvori struje – podjela

- Primarni (primarne baterije)
- Sekundarni (akumulatori)
- Gorivne ćelije (elektrokataliza)
- + Elektrohemografski kondenzatori (kasnije)



Primarni izvori

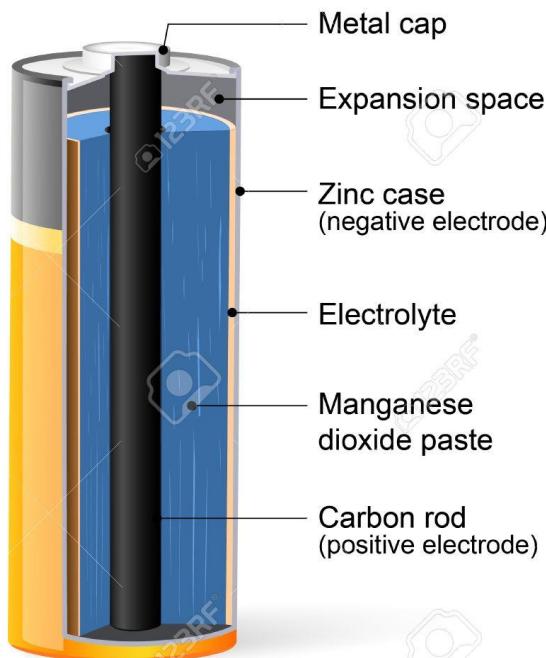
- Suvi element / Leklanšeova ćelija / Zn-C baterija / Zn-MnO₂ baterija
- Najstariji hemijski izvor struje



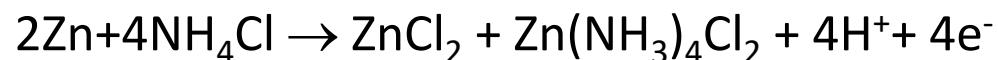
Primarni izvori

Suvi element / Leklanšeova ćelija / Zn-C baterija / Zn-MnO₂ baterija (1.5 V)

Dry cell battery



Na anodi:

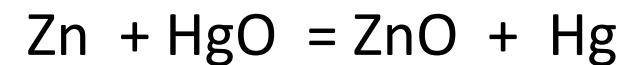
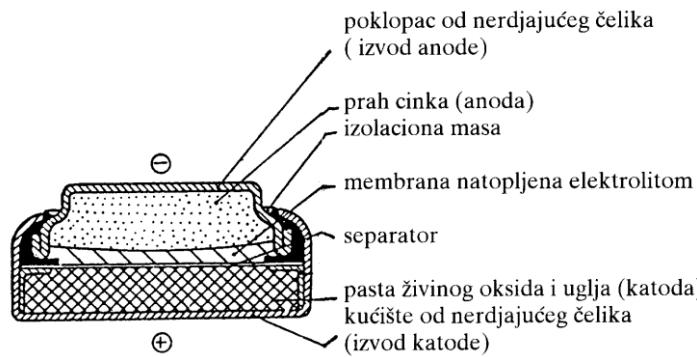


Na katodi:

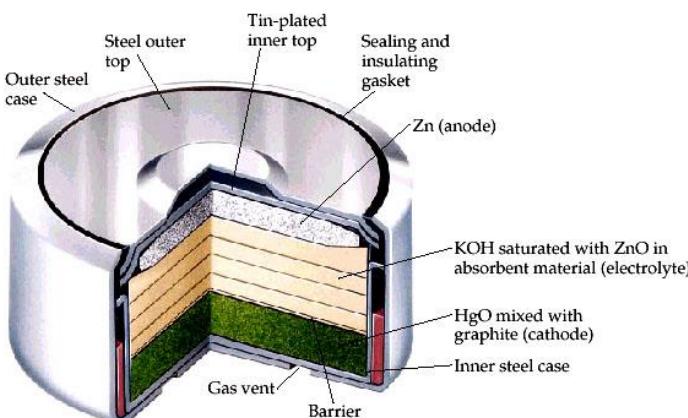


Primarni izvori

Zn-HgO baterija (minijaturna baterija, coin cell, button cell)



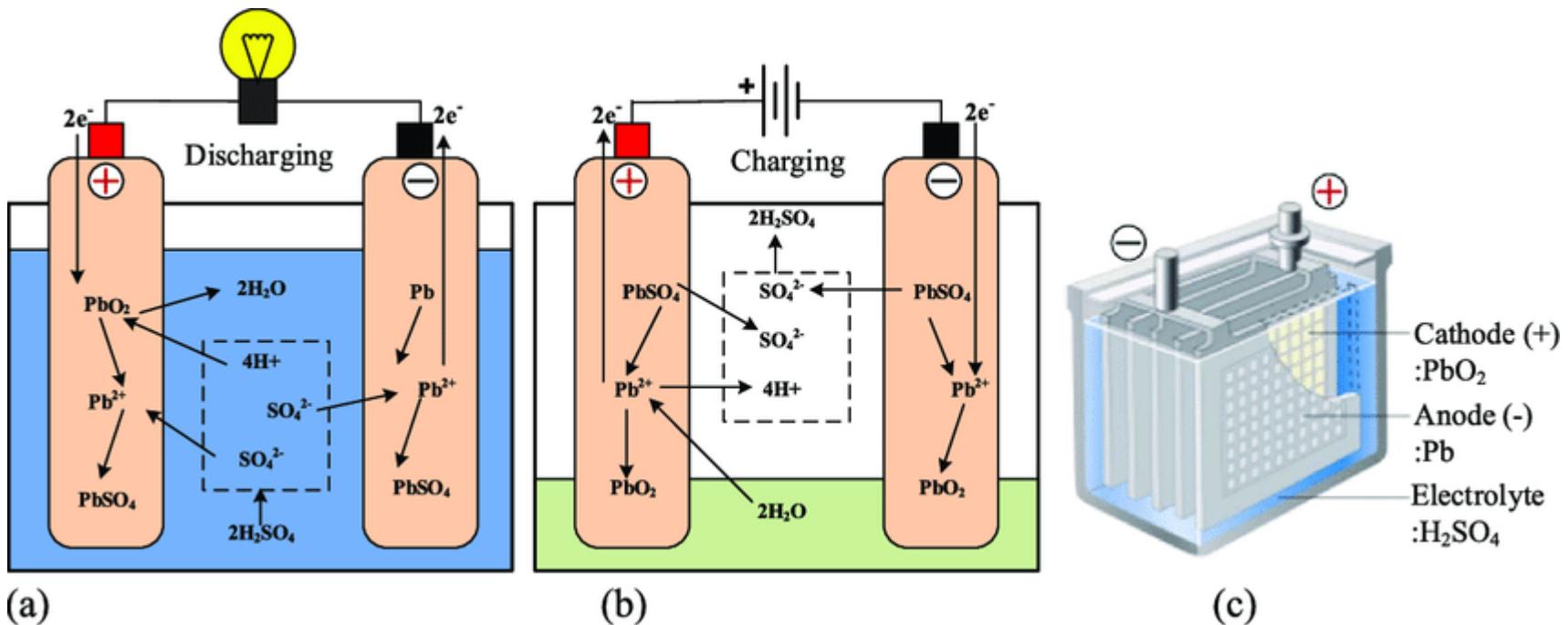
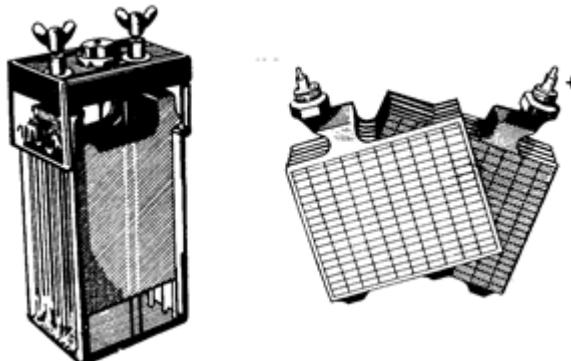
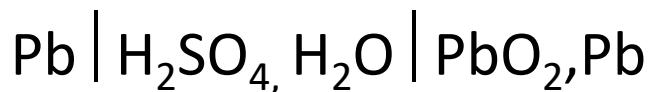
$$\varepsilon = \varepsilon^0 - \frac{RT}{2F} \ln \frac{a_{\text{ZnO}} a_{\text{Hg}}}{a_{\text{HgO}} \cdot a_{\text{Zn}}}$$



$$\varepsilon^0 = 1,36 \text{ V}$$

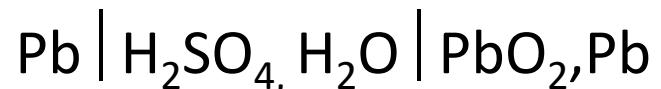
Sekundarni izvori

- Olovni akumulator (~ 2 V)



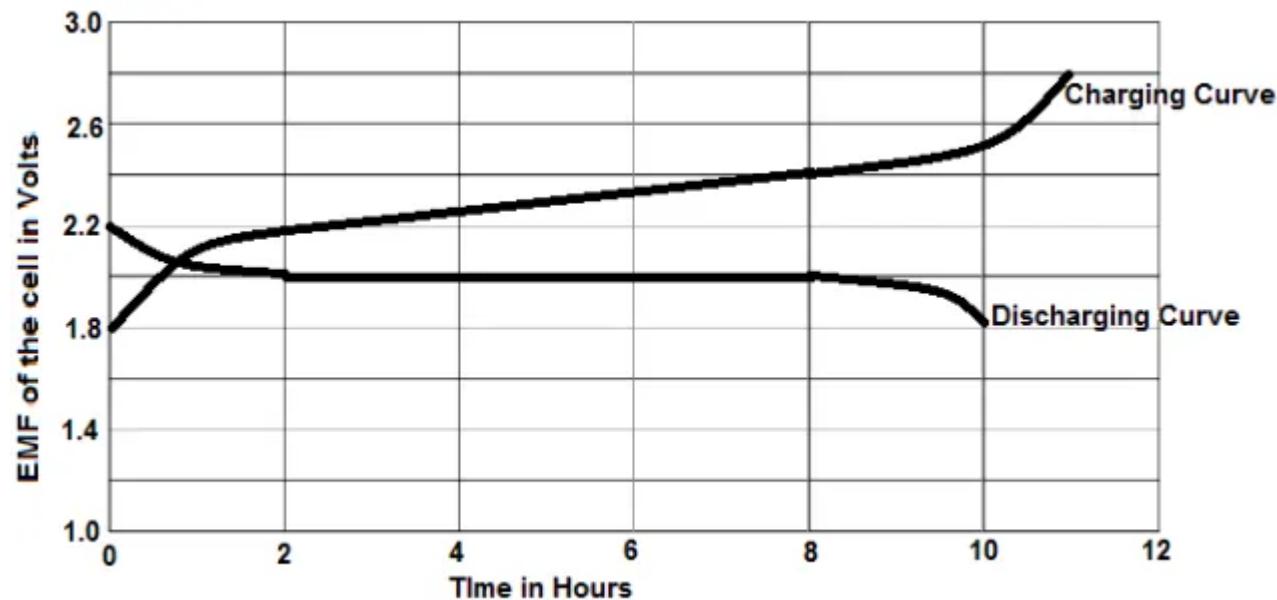
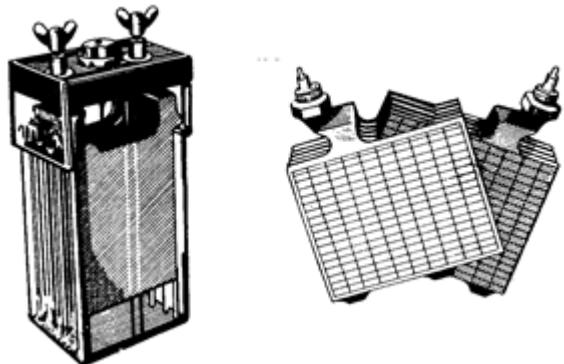
Sekundarni izvori

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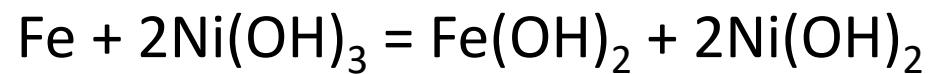
$$\mathcal{E} = \mathcal{E}^0 - \frac{RT}{2F} \ln \frac{a_{\text{PbSO}_4}^2 \cdot a_{\text{H}_2\text{O}}^2}{a_{\text{Pb}} \cdot a_{\text{PbO}_2} \cdot a_{\text{H}_2\text{SO}_4}^2}$$

$$\mathcal{E} = \mathcal{E}^0 - \frac{RT}{F} \ln \frac{a_{\text{H}_2\text{O}}}{a_{\text{H}_2\text{SO}_4}}$$
 Približno konstantno

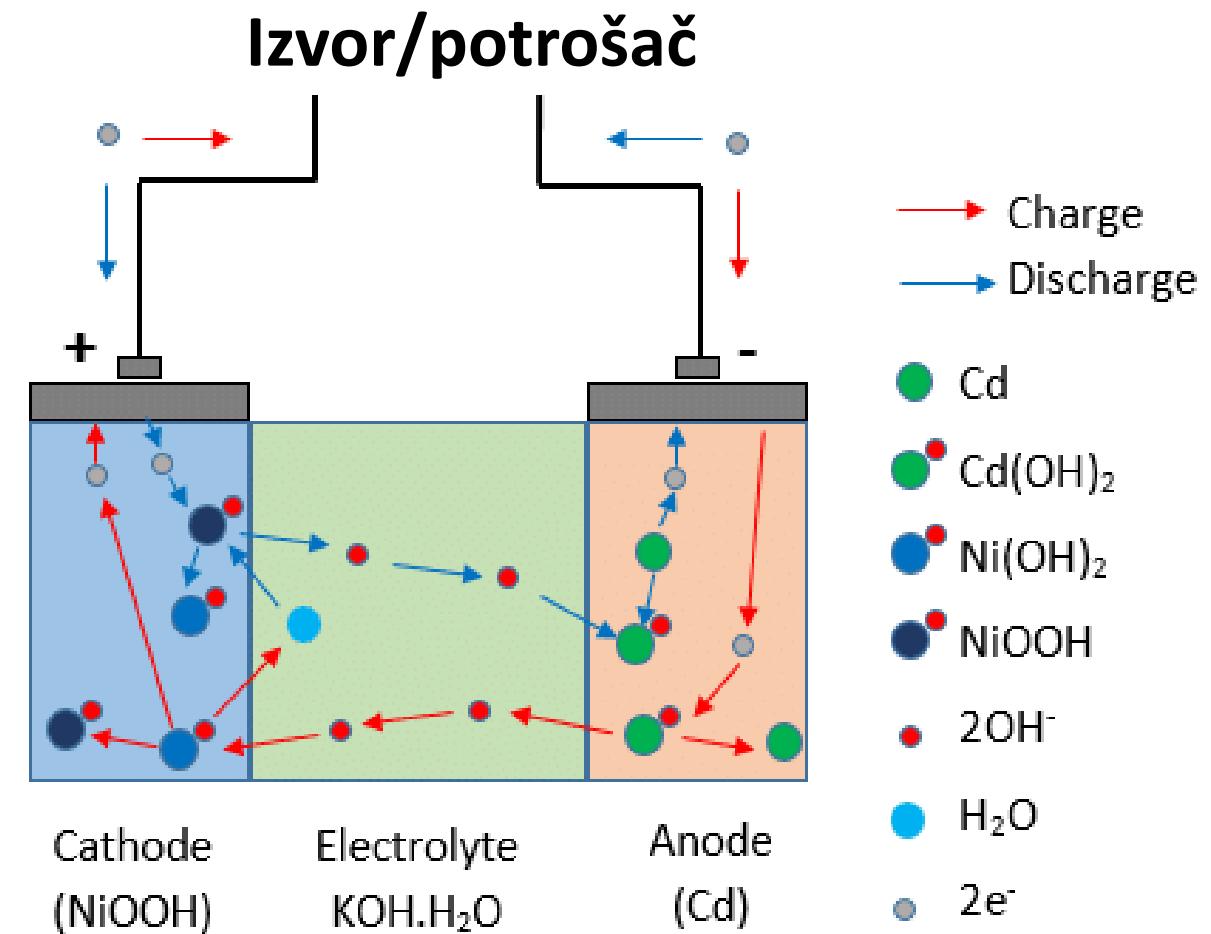


Sekundarni izvori

- Alkalni akumulatori (1.35 V)



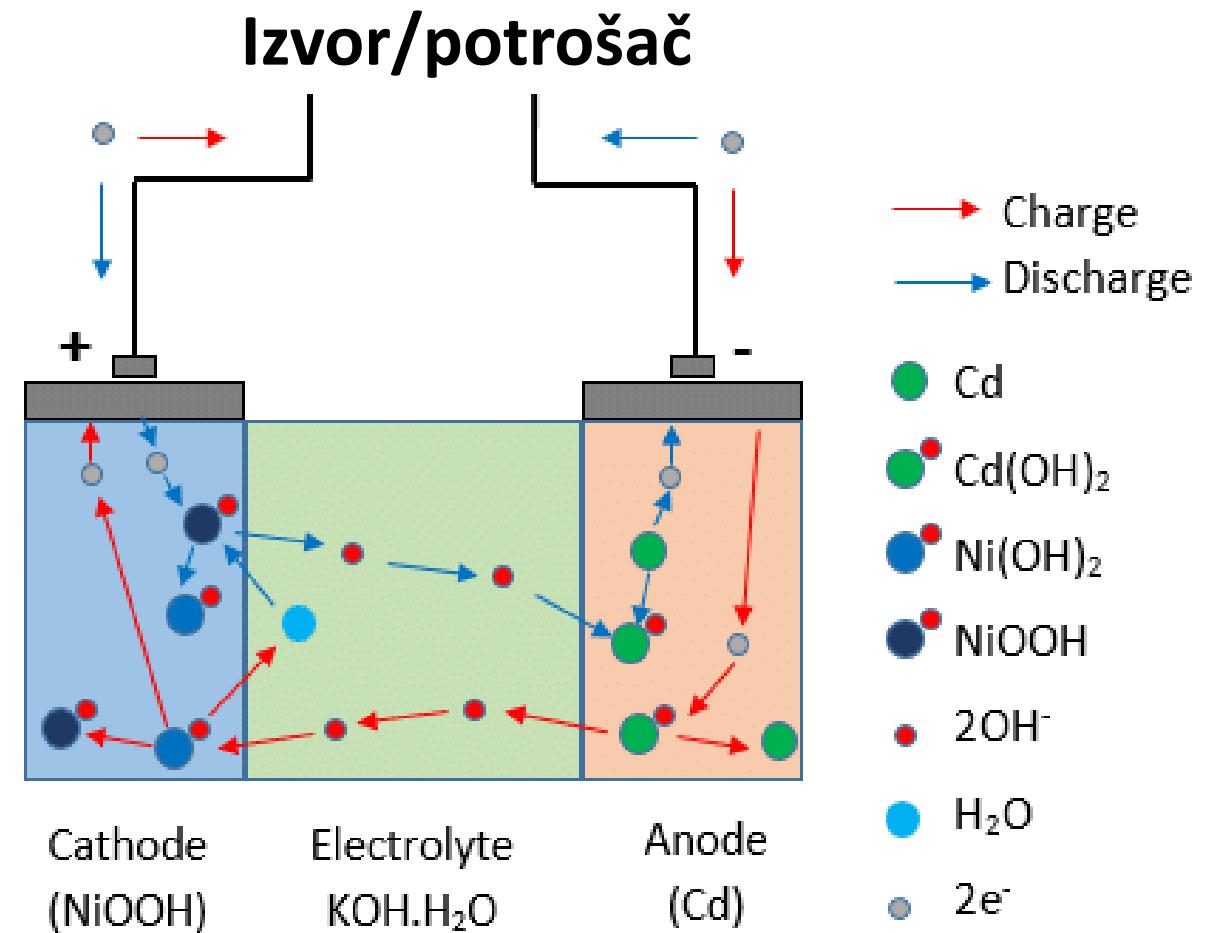
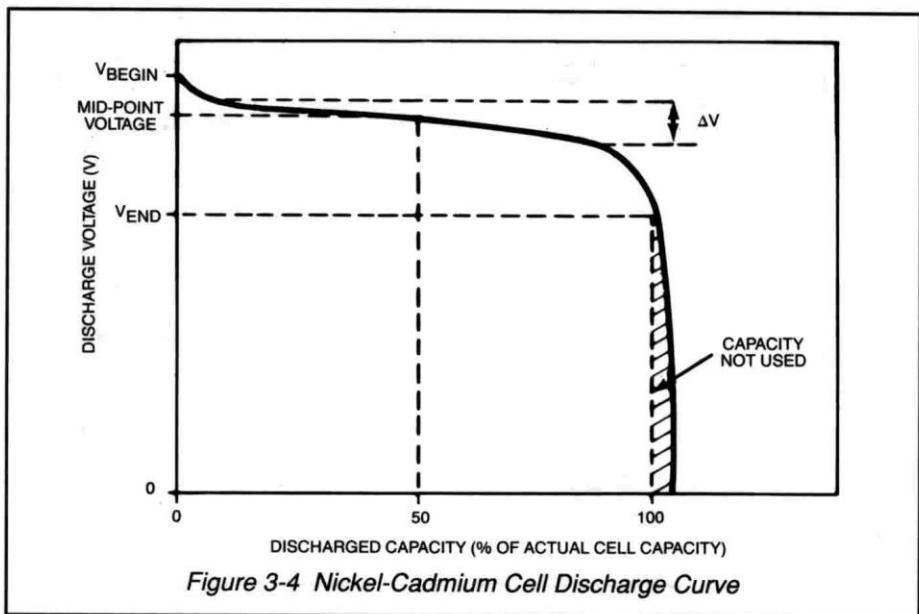
$$\varepsilon = \varepsilon^0 - \frac{RT}{zF} \ln \frac{a_{\text{Ni(OH)}_2}^2 \cdot a_{M(\text{OH})_2}}{a_{\text{Ni(OH)}_3}^2 \cdot a_M}$$



Sekundarni izvori

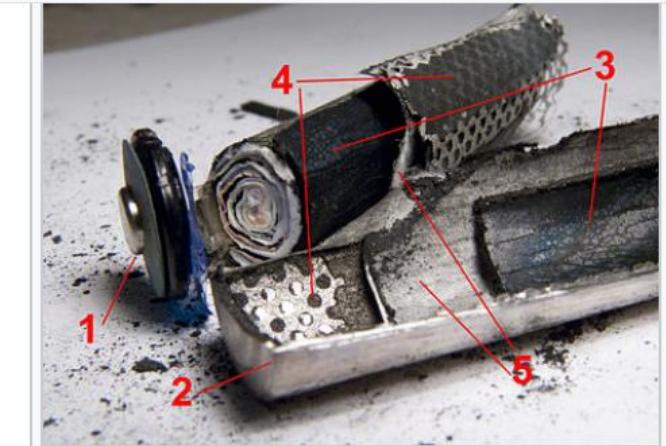
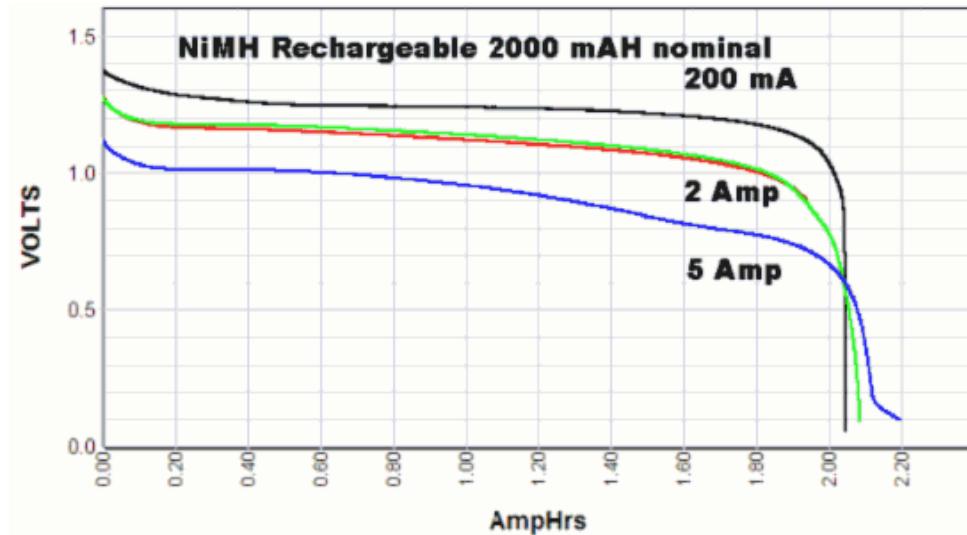
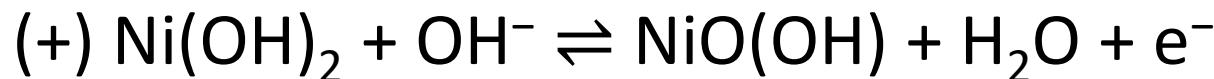
- Alkalni akumulatori (1.35 V)

$$\varepsilon = \varepsilon^0 - \frac{RT}{zF} \ln \frac{a_{Ni(OH)_2}^2 \cdot a_{M(OH)_2}}{a_{Ni(OH)_3}^2 \cdot a_M}$$



Još neki tipovi sekundarnih izvora

- Ni-MH baterije

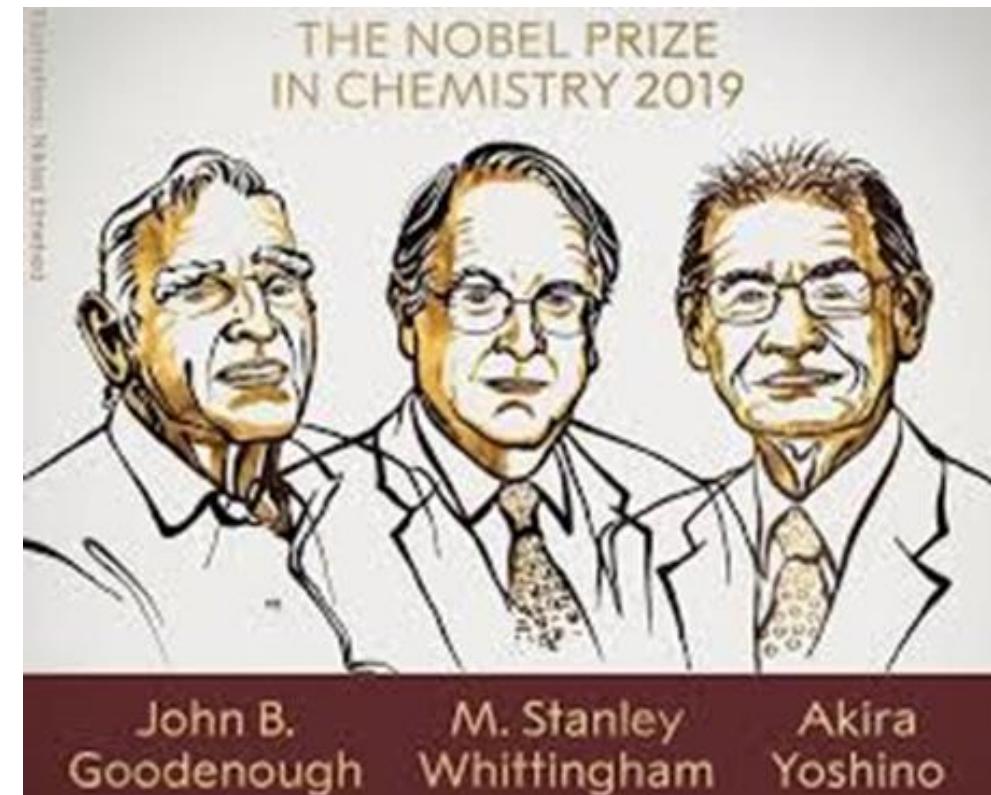
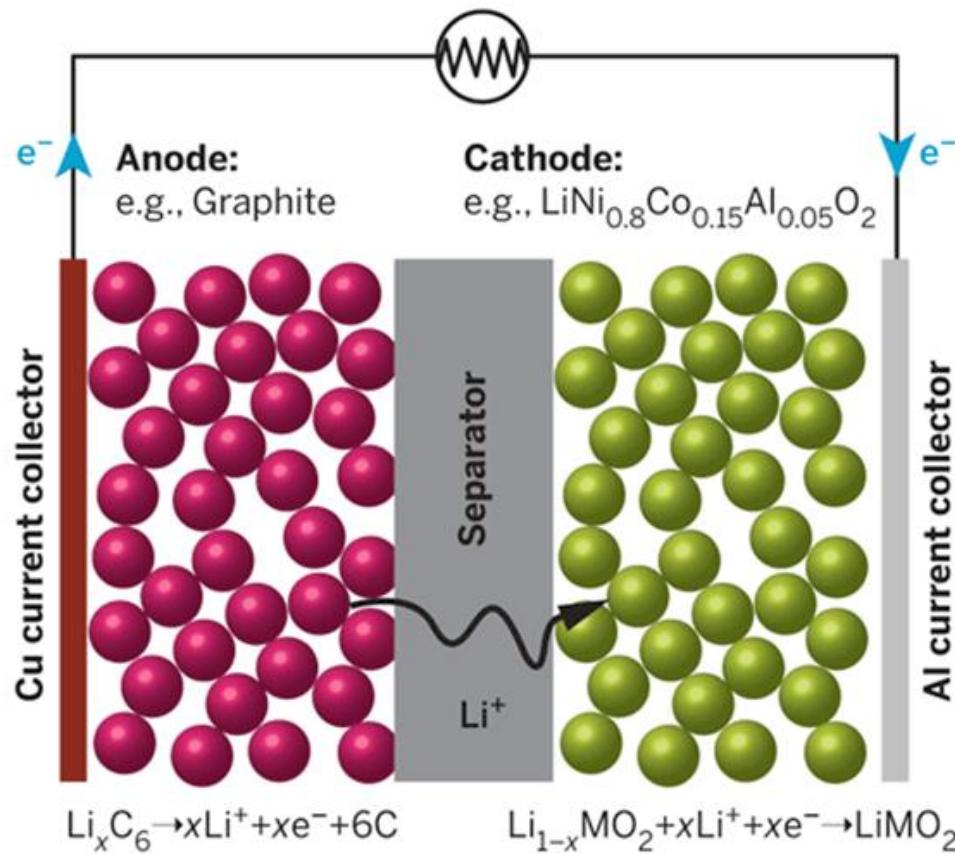


Disassembled NiMH AA battery:

1. Positive terminal
2. Outer metal casing (also negative terminal)
3. Positive electrode
4. Negative electrode with current collector (metal grid, connected to metal casing)
5. Separator (between electrodes)

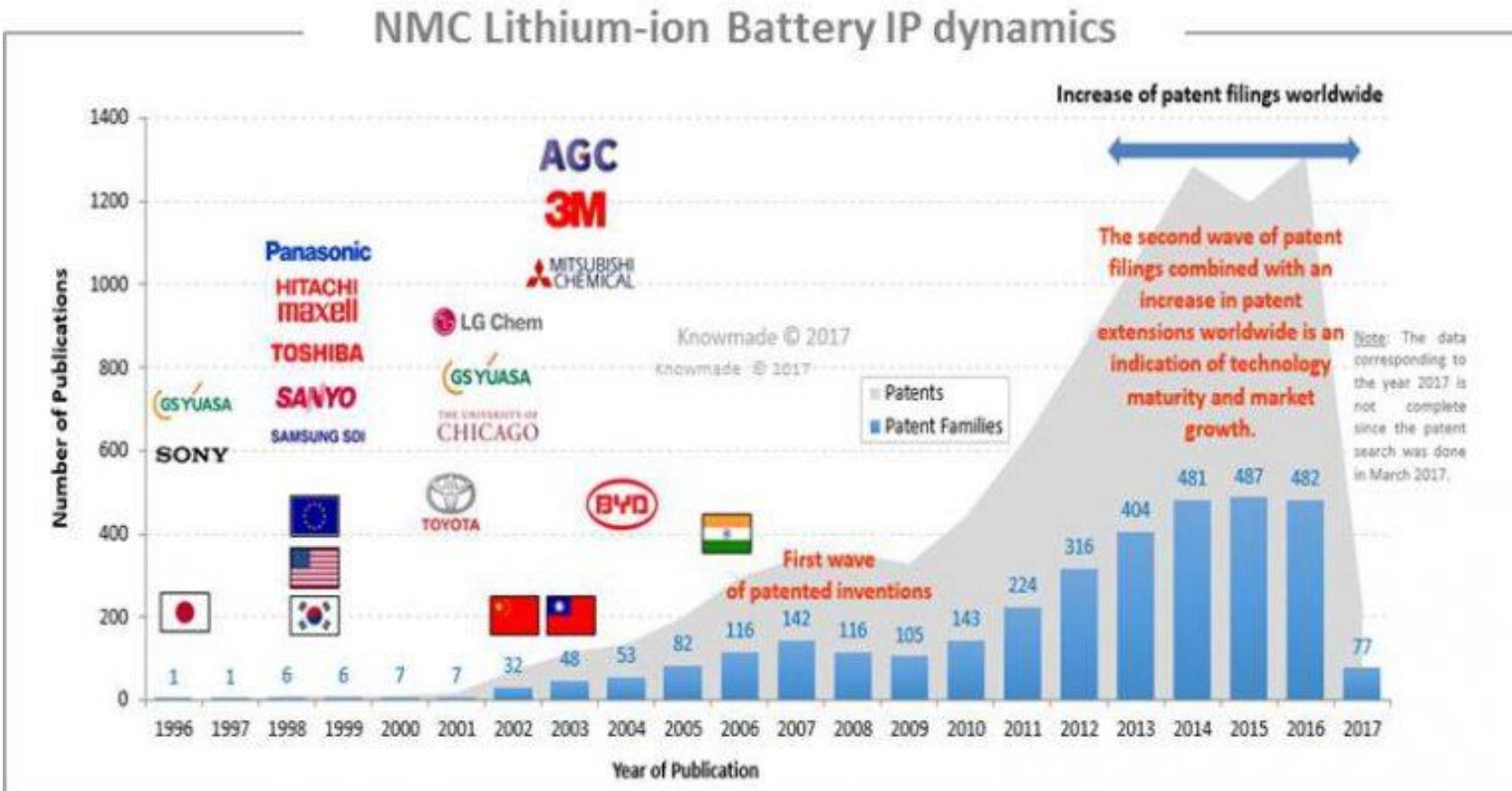
Još neki tipovi sekundarnih izvora

- Li-ionske baterije



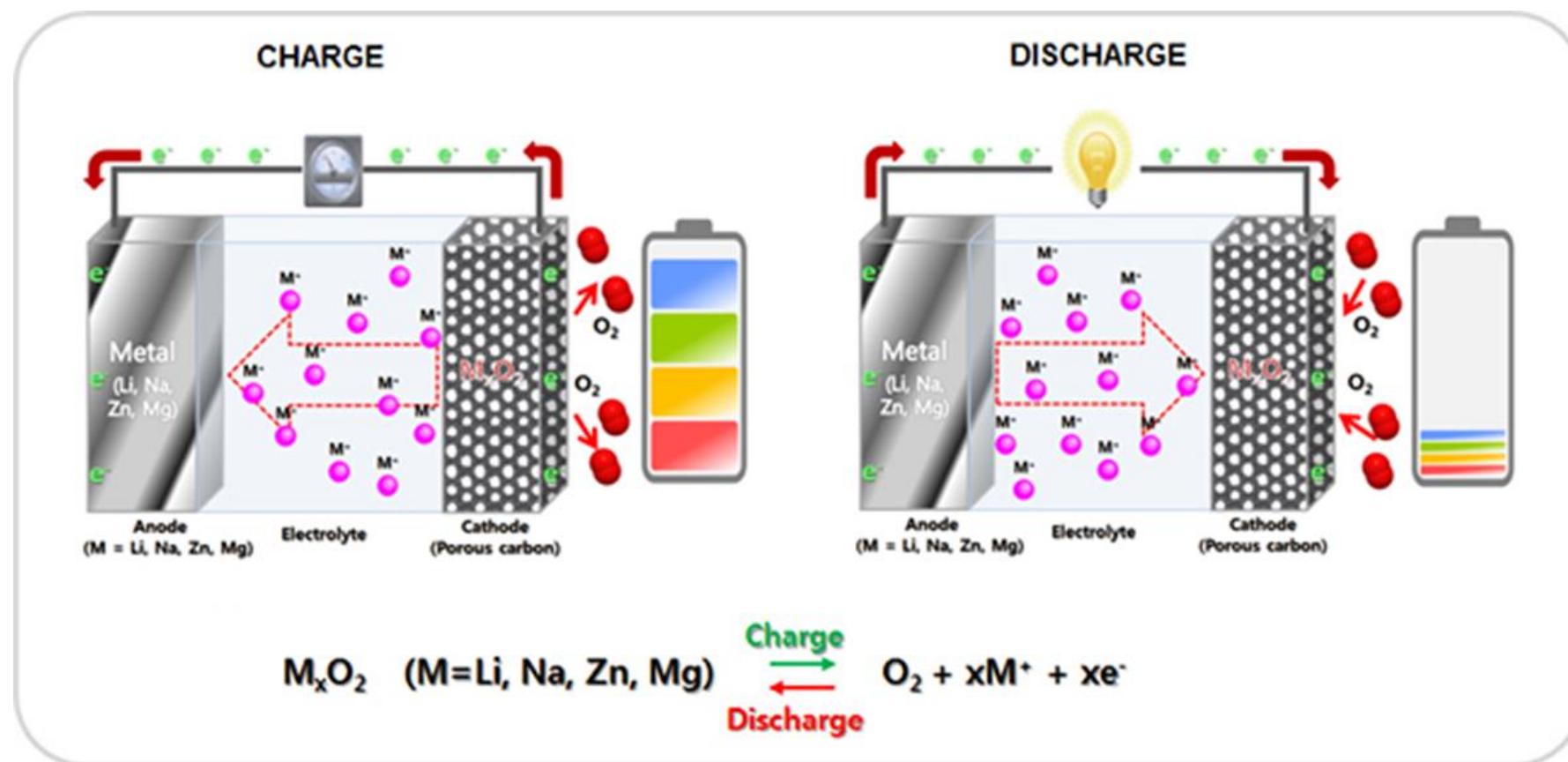
Još neki tipovi sekundarnih izvora

- Li-jonske baterije

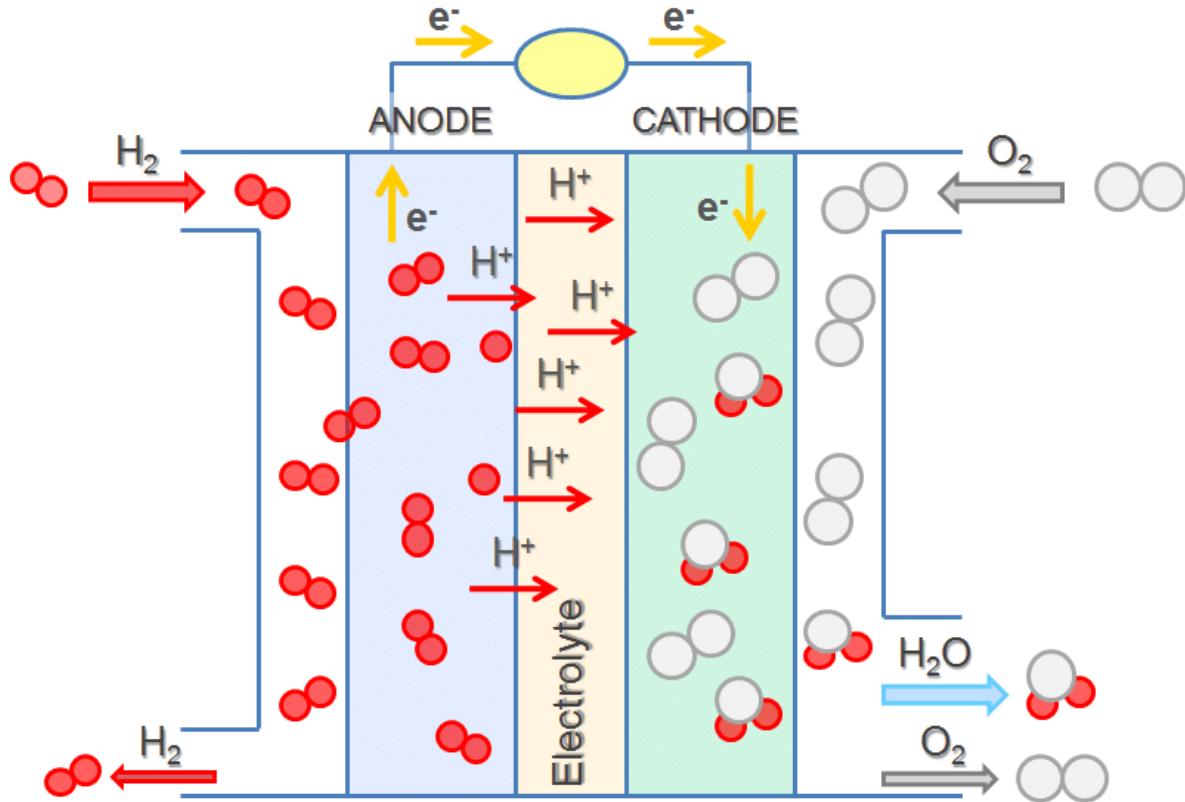


Još neki tipovi sekundarnih izvora

Metal-vazduh baterije



Gorivne ćelije



PEMFC

Anoda – oksidacija H_2
Katoda – redukcija O_2

Standardi veličina



Korisni linkovi

- [https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_\(Zumdahl_and_Decoste\)/11%3A_Electrochemistry/11.5%3A_Batteries](https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_(Zumdahl_and_Decoste)/11%3A_Electrochemistry/11.5%3A_Batteries)
- https://en.wikipedia.org/wiki/List_of_battery_sizes
- **DODATNO ZA ZAINTERESOVANE**
- <http://www.ffh.bg.ac.rs/wp-content/uploads/2019/04/Doktorske-studije-Ivana-Stojkovic-Simatovic.pdf> (opšte o Li-jonskim baterijama, predavanje Prof. Ivane Stojković-Simatović na doktorskim studijama)
- <http://www.ffh.bg.ac.rs/wp-content/uploads/2019/04/PhD-PtC.pdf> (platinski katalizatori za gorivne ćelije, predavanje Prof. Nemanje Gavrilova na doktorskim studijama)