

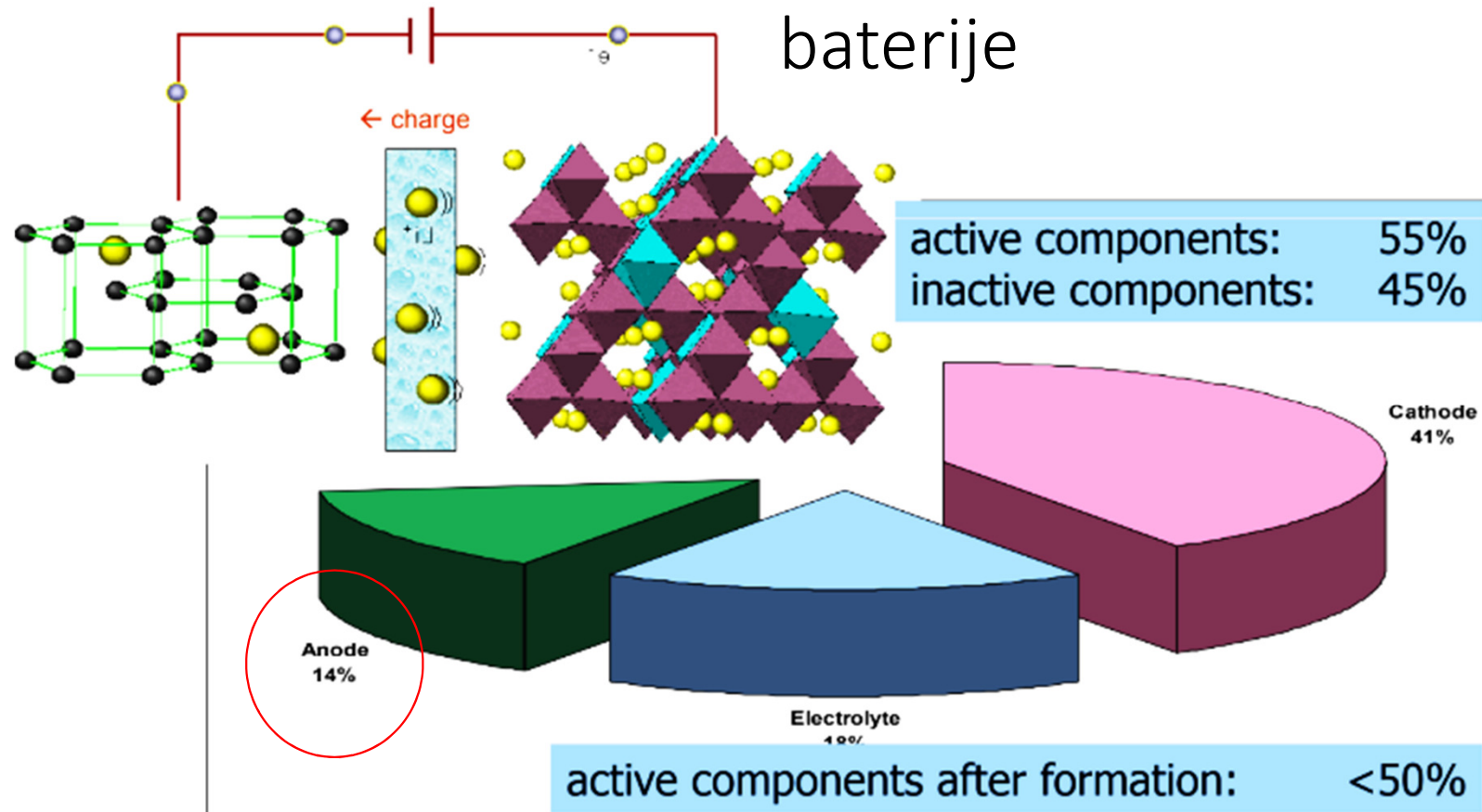
# Nova generacija anoda za Li-ionske baterije

Institut Ruđer Bošković

Zavod za fiziku materijala

Laboratorij za molekulska fiziku i  
sinteze novih materijala

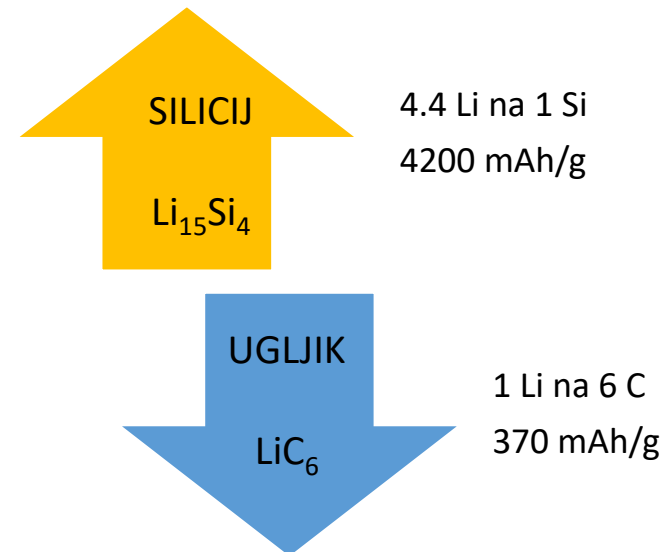
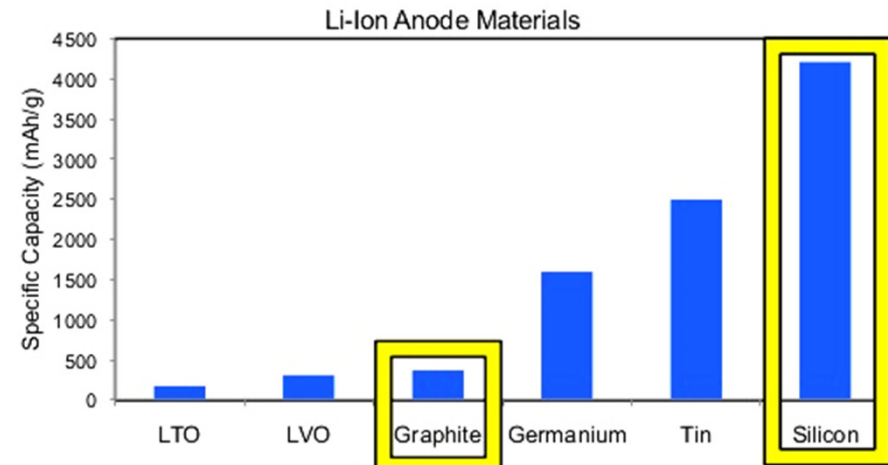
# Osnovne komponente baterije



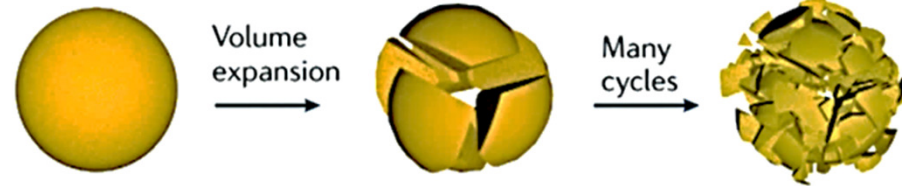
# Zašto silicij?

1. Potreba za većom gustoćom energije
2. Jeftinija i sigurnija izvedba
3. Dulji životni vijek baterije

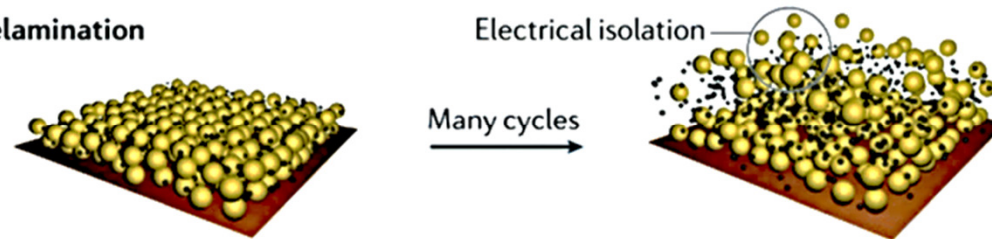
- Ekološki i ekonomski prihvatljiv
- Lagan i tanak → mikroelektrode
- Postiže veće kapacitete u odnosu na komercijalnu grafitnu elektrodu
- Operativni potencijal: 0.4 V vs Li/Li<sup>+</sup> za silicij  
0.05 V vs Li/Li<sup>+</sup> za ugljik



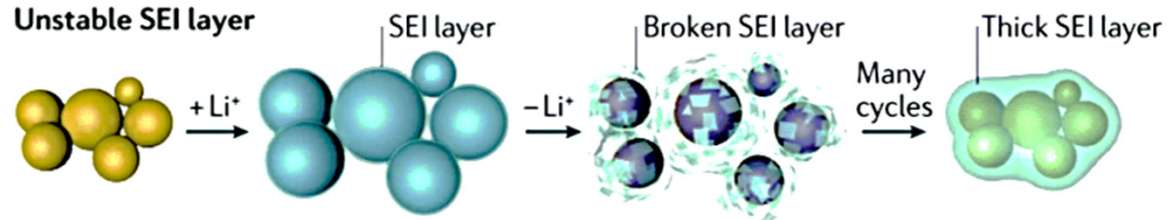
### Pulverization



### Delamination



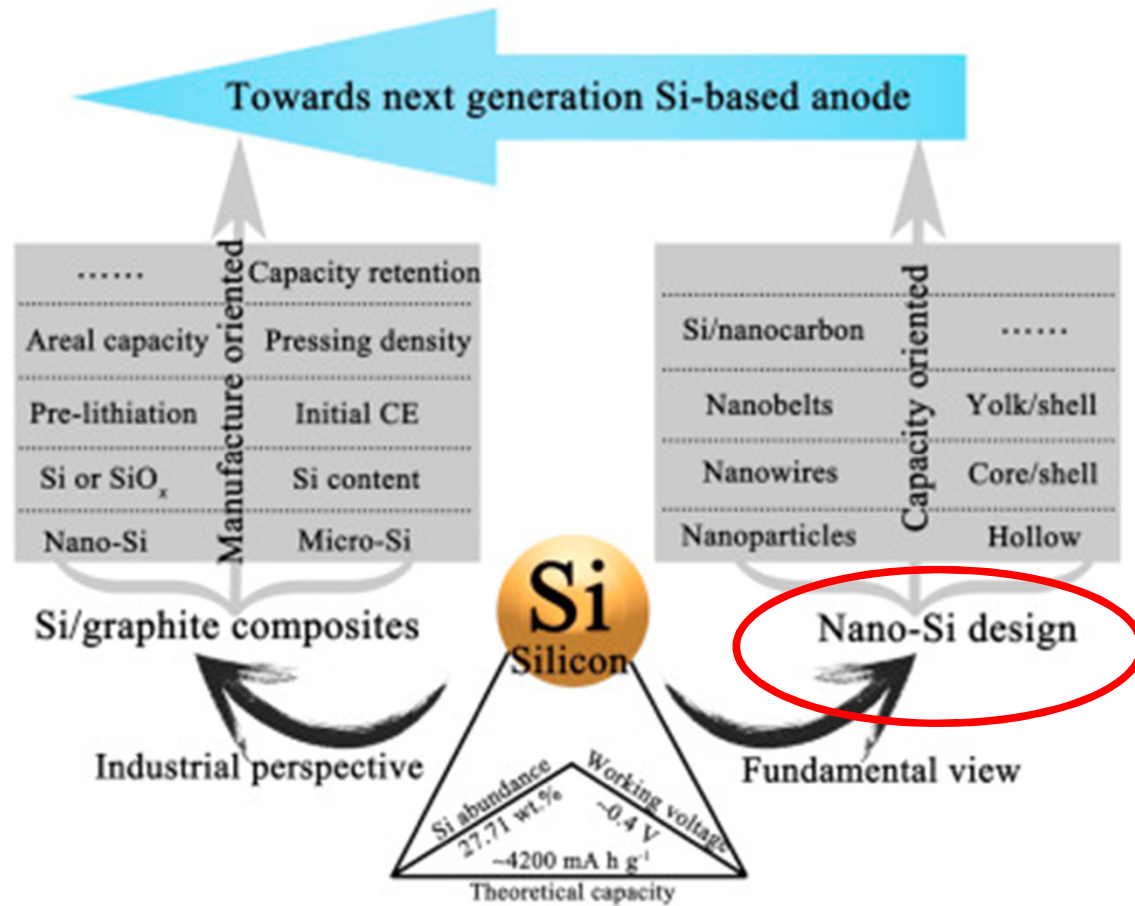
### Unstable SEI layer



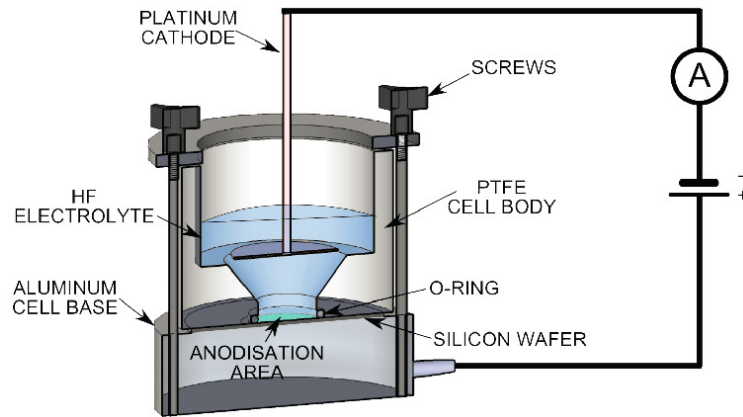
Problem?

- Ekspanzija volumena silicija (320%)
- Pucanje elektrode
- Gubitak električnog kontakta

Moguća  
rješenja

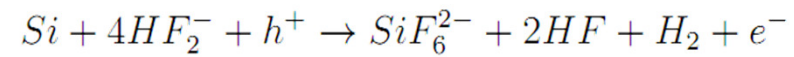


# Porozni silicij

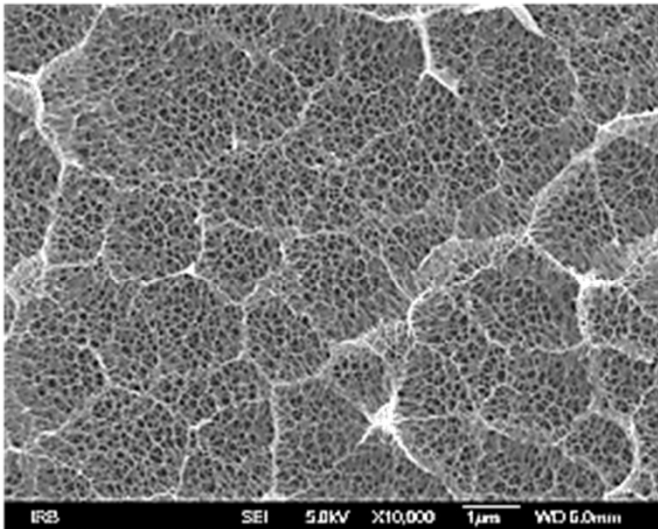
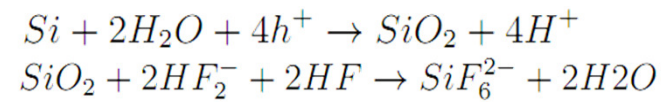


Anodization of (bulk) silicon wafers

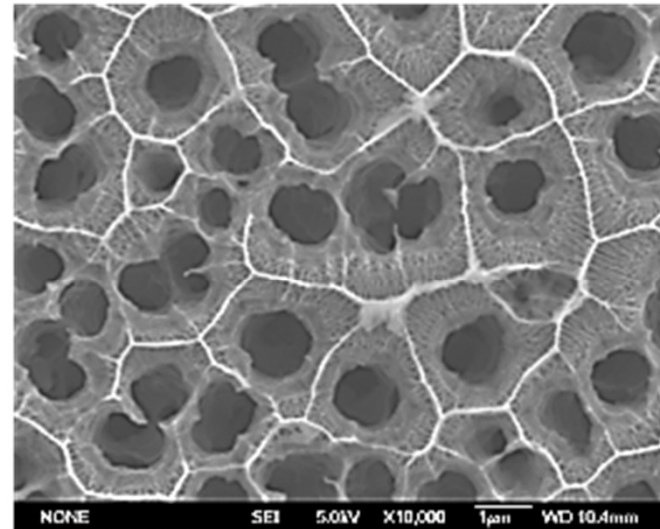
Porous Si formation ( $J < J_{ps}$ ):



Electropolishing ( $J > J_{ps}$ ):



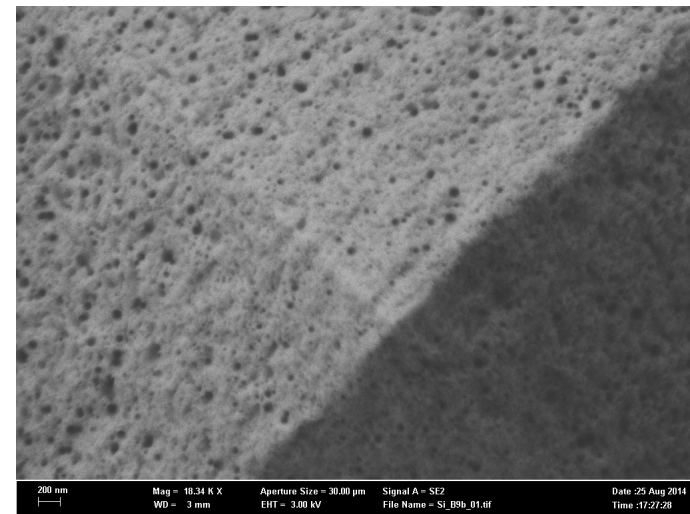
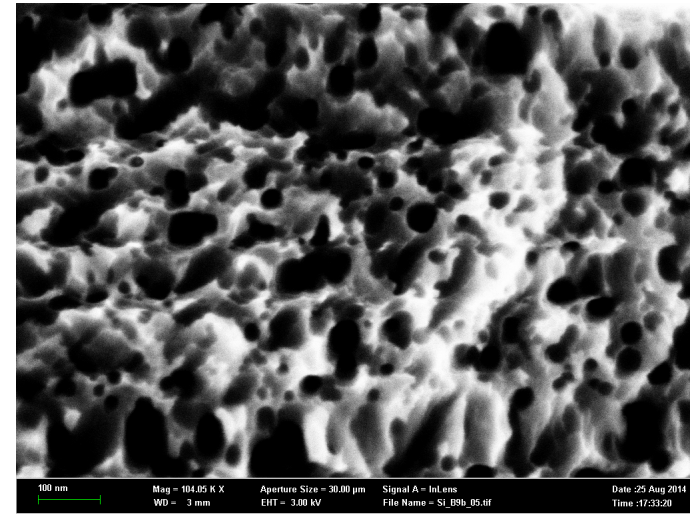
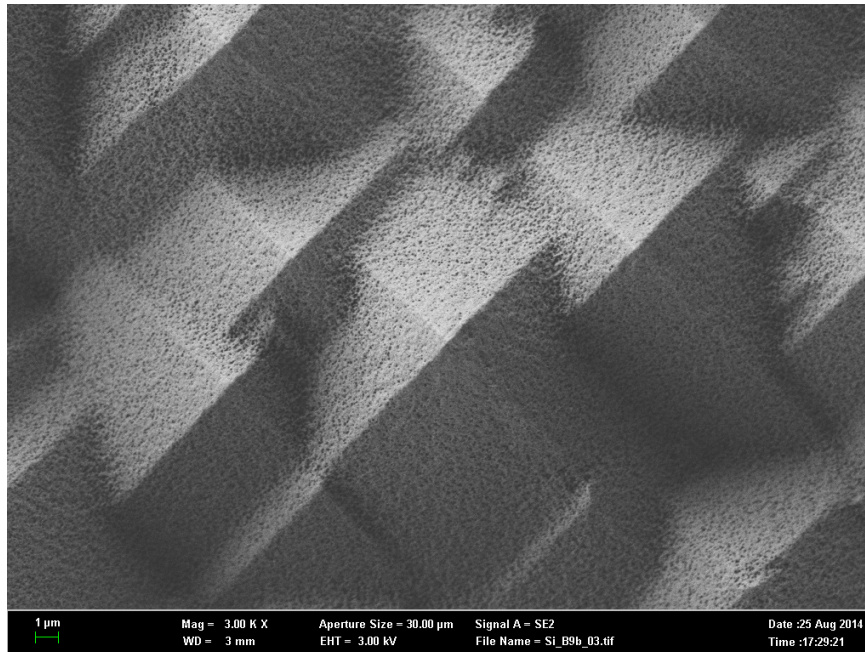
(a)



(b)

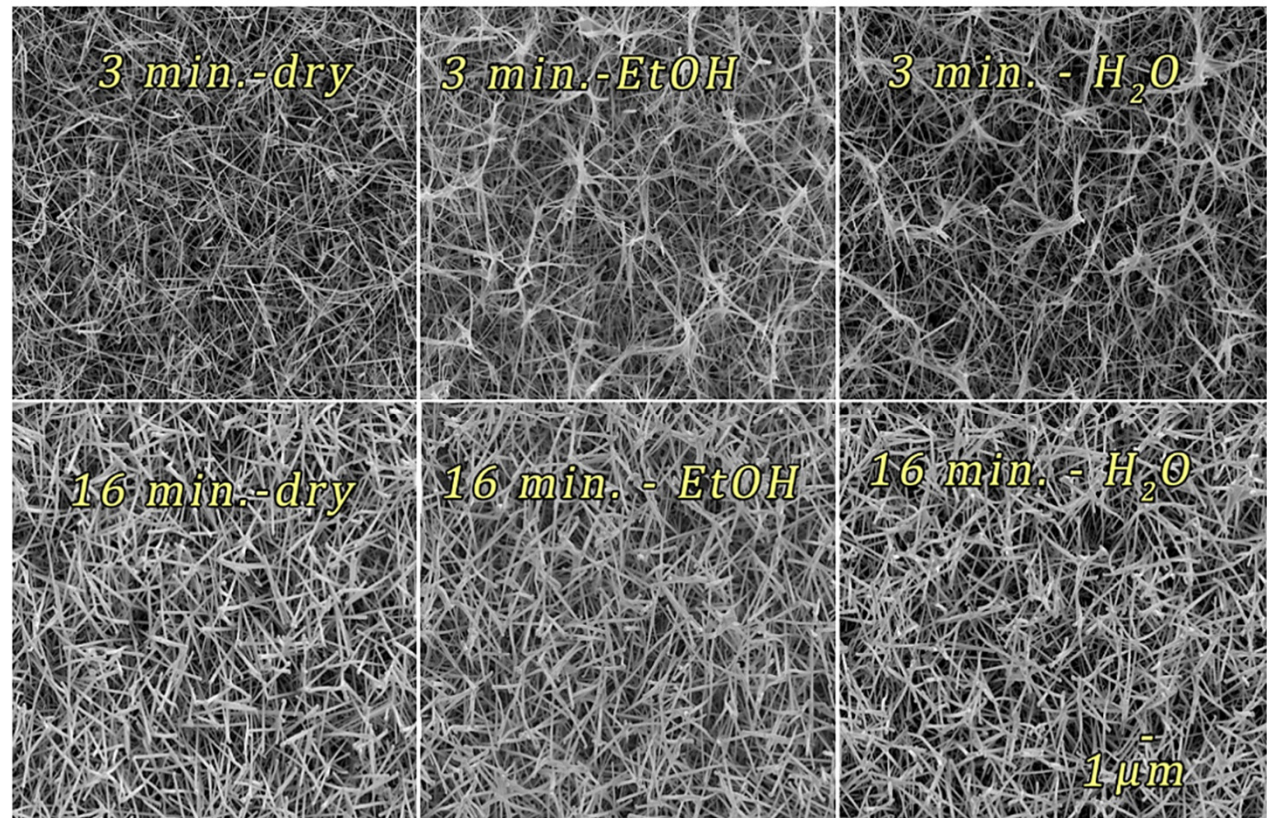
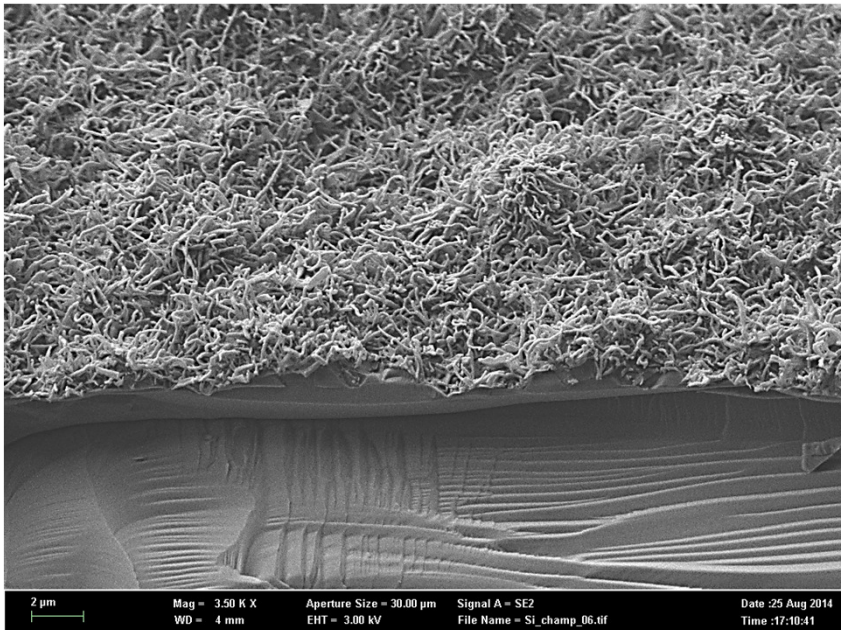
# Hierarchically structured

Micro-pyramids (KOH/IPA) + porous Si

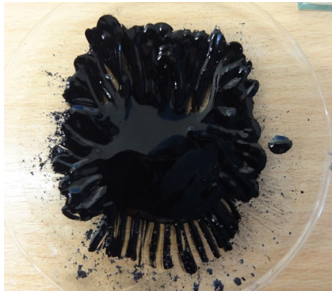


# Silicijske nanožice

- Metal-catalyzed silicon electroless etching (Ag, Au nanoparticles + HF + H<sub>2</sub>O<sub>2</sub>)
- Light capture for solar cells and photosensing, chemical sensing



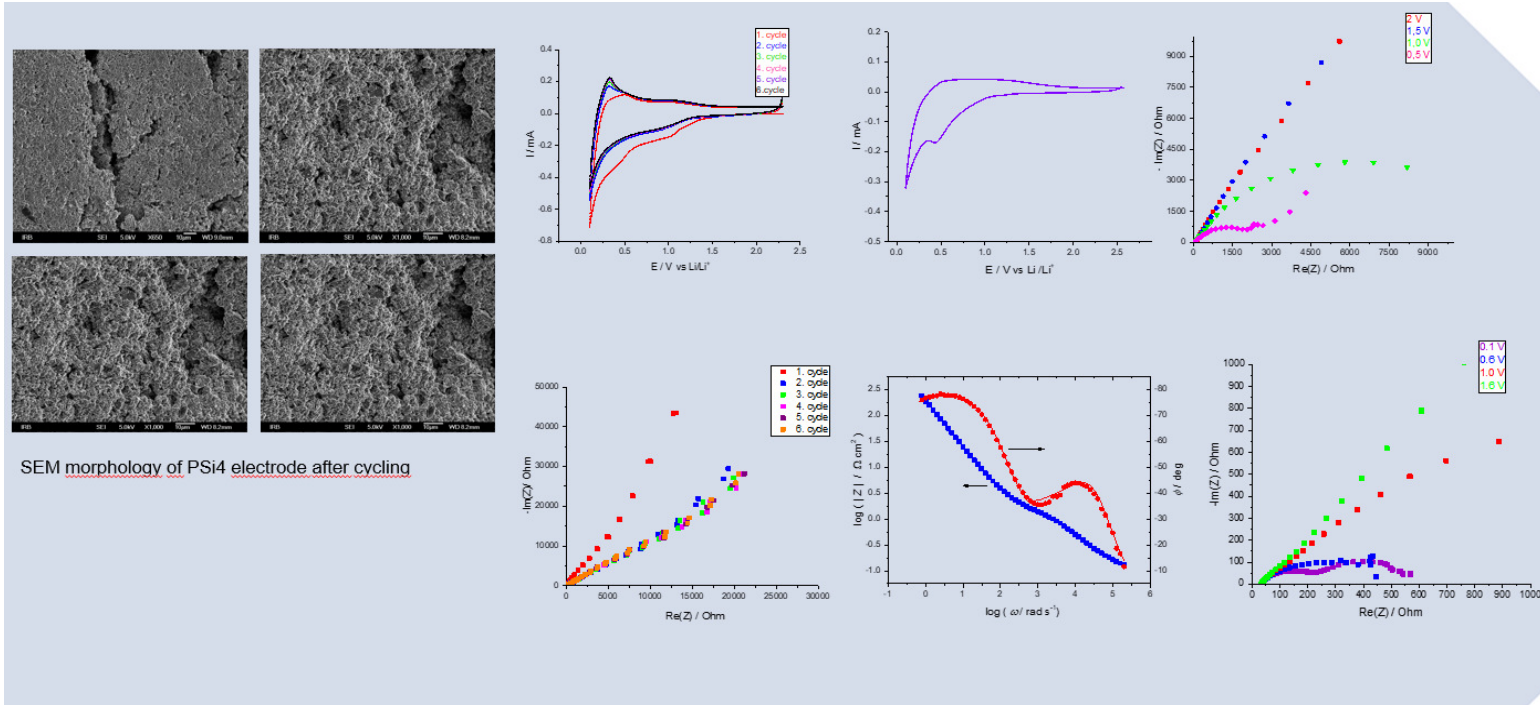




Si powder : binder(PvdF) : carbon black (CB)

60 : 20 : 20

SOLVENT: N-Methyl-2-pyrrolidone (NMP)



Preliminarna ispitivanja

## Istraživački tim

### IRB Laboratorij za molekulsku fiziku

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Članovi: Davor Ristić, Hrvoje Gebavi, Lara Mikac, Vlasta Mohaček  
Grošev, Daniil Životkov, Vlatko Gašparić, Nikola Baran, Matea Raić

### **We are grateful for the funding of our work:**

This work has been partially supported by a project co-financed by the Croatian Government and the European Union through the European Regional Development Fund - the Competitiveness and Cohesion Operational Programme (KK.01.1.1.01)."

Preliminarna ispitivanja napravljena su u suradnji s istraživačkom grupom prof. dr. sc. Mandića.