PHOTOCURRENT GENERATED BY PHOTOSYNTHETIC REACTION CENTER BASED NANOCOMPOSITES

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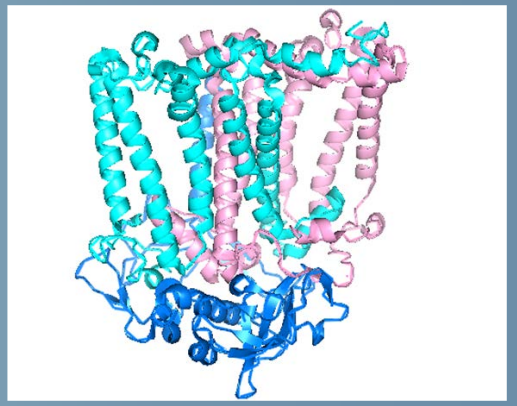
Introduction

- Hibrid materials
- Bio-nanocomposites
- Efficient strategies of living organism
- Photosynthetic reaction center protein (RC) - „natural solar cell”

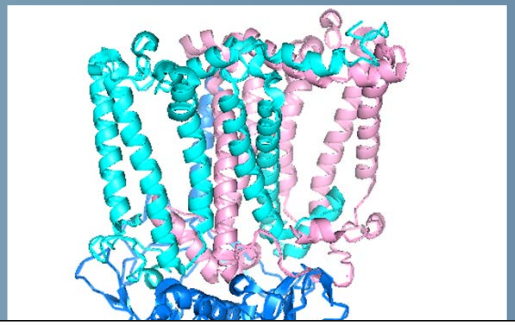
Structure of talk

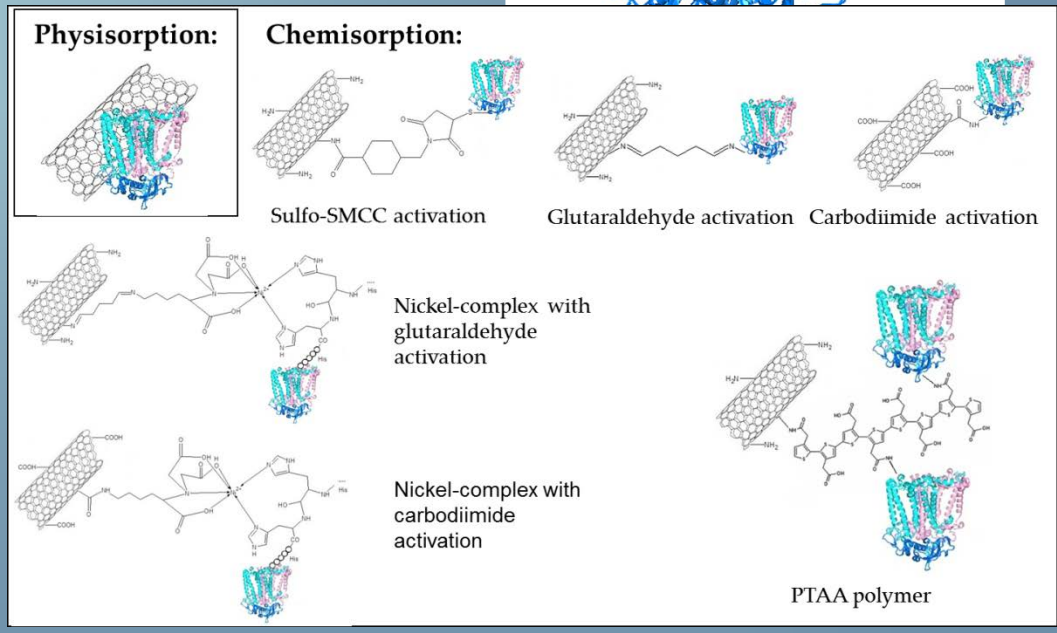
- Reaction center protain



Structure of talk

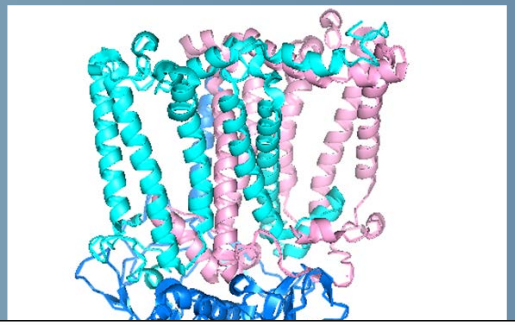
- Reaction center protain
- Binding strategies

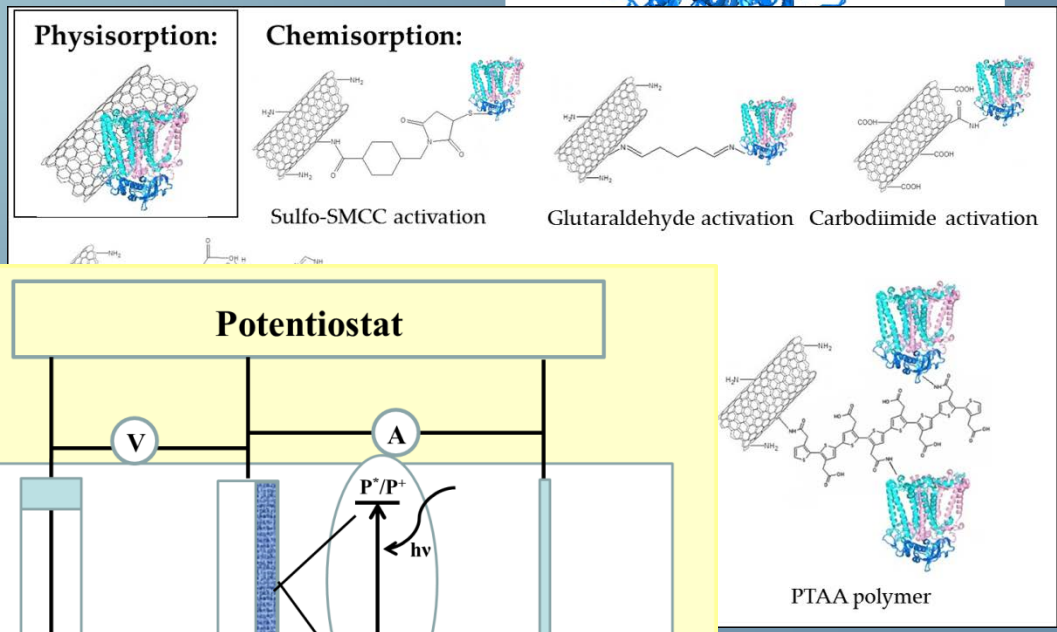


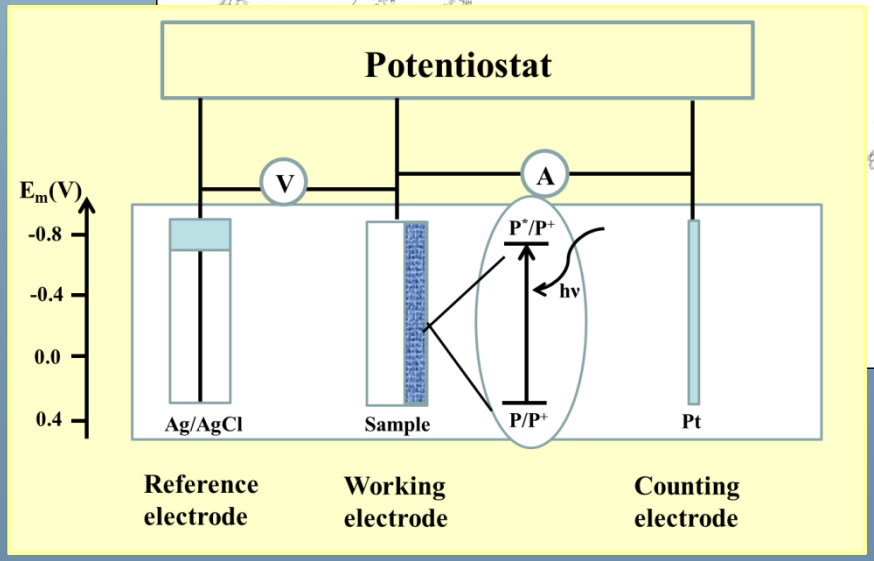


Structure of talk

- Reaction center protain
- Binding strategies
- Electrochemistry

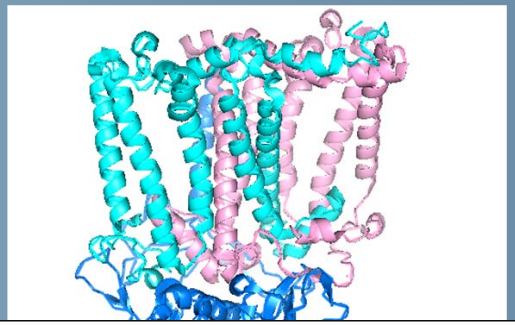


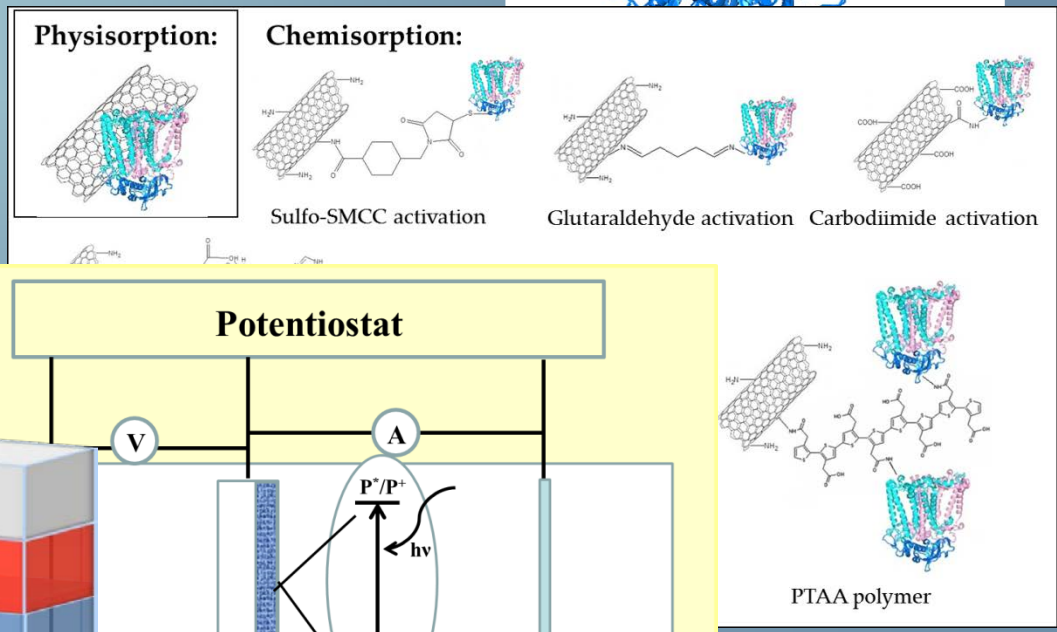


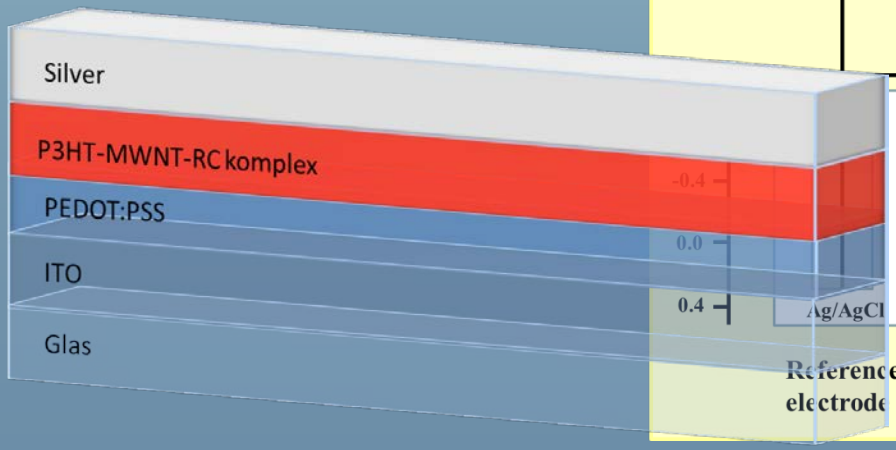


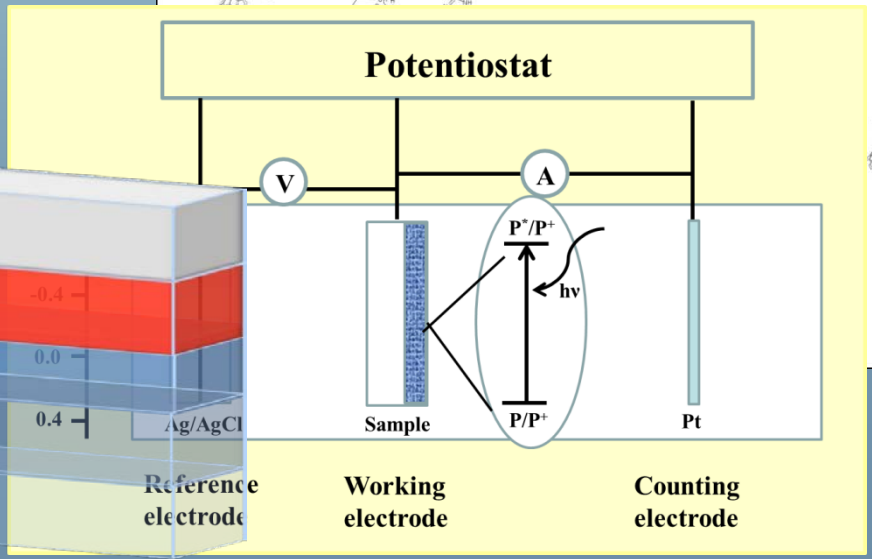
Structure of talk

- Reaction center protein
- Binding strategies
- Electrochemistry
- Dried samples



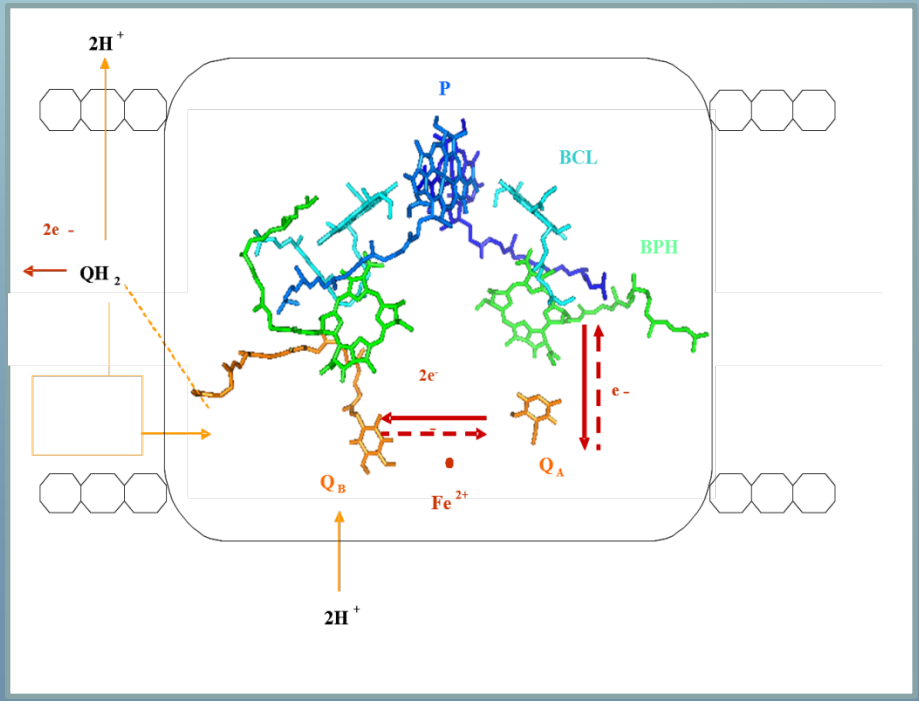


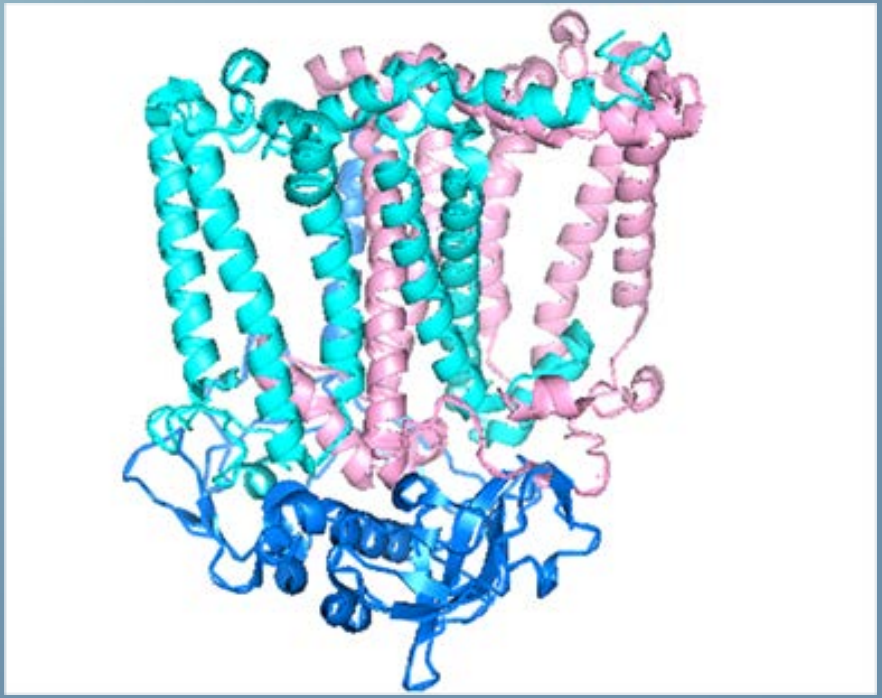




Light energy conversion in living organism

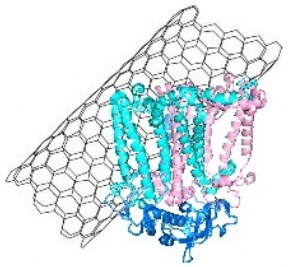
- Photosynthetic reaction center protein (RC) purified from *Rhodobacter sphaeroides* R-26



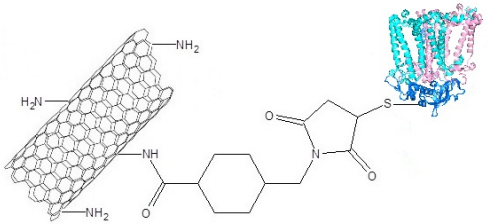


Summary of the CNT/RC binding procedures

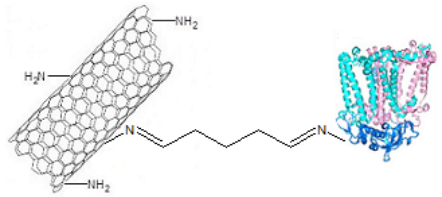
Physisorption:



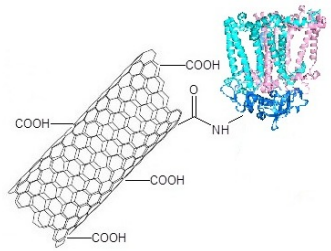
Chemisorption:



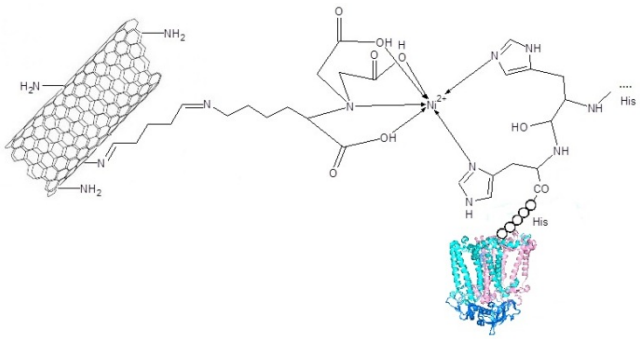
Sulfo-SMCC activation



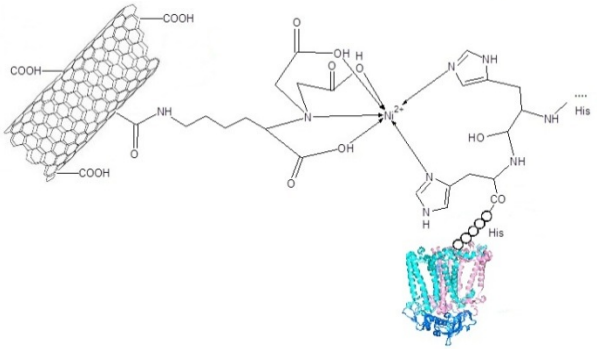
Glutaraldehyde activation



Carbodiimide activation



Nickel-complex with glutaraldehyde activation



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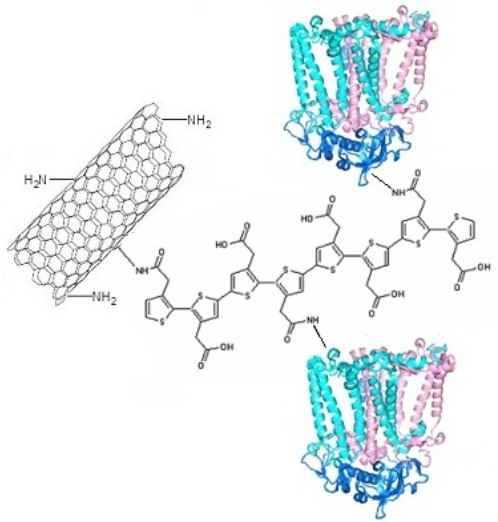

PTAA polymer

Summary of the CNT/RC binding procedures

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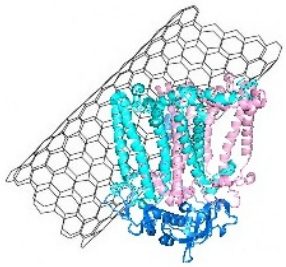

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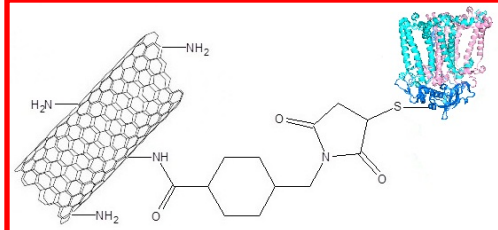

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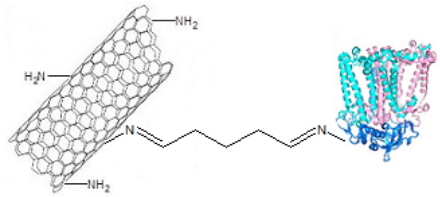
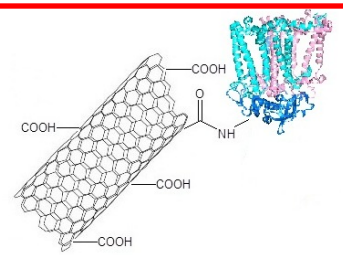
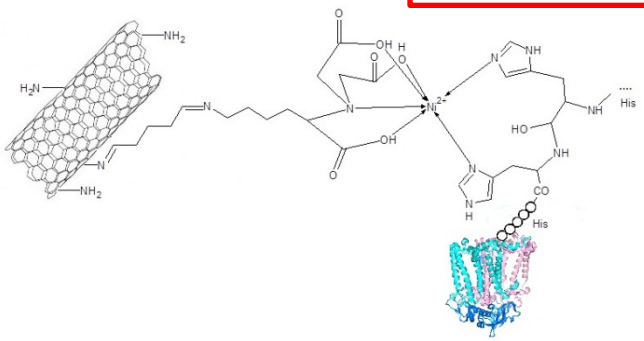


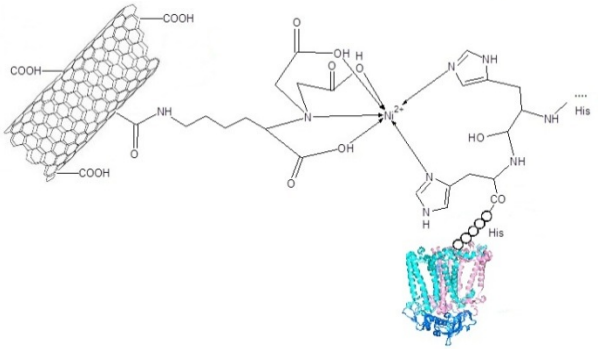
Glutaraldehyde activation



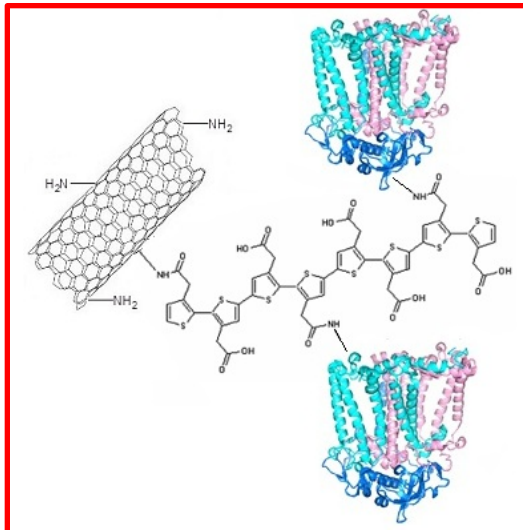
Carbodiimide activation



Nickel-complex with glutaraldehyde activation



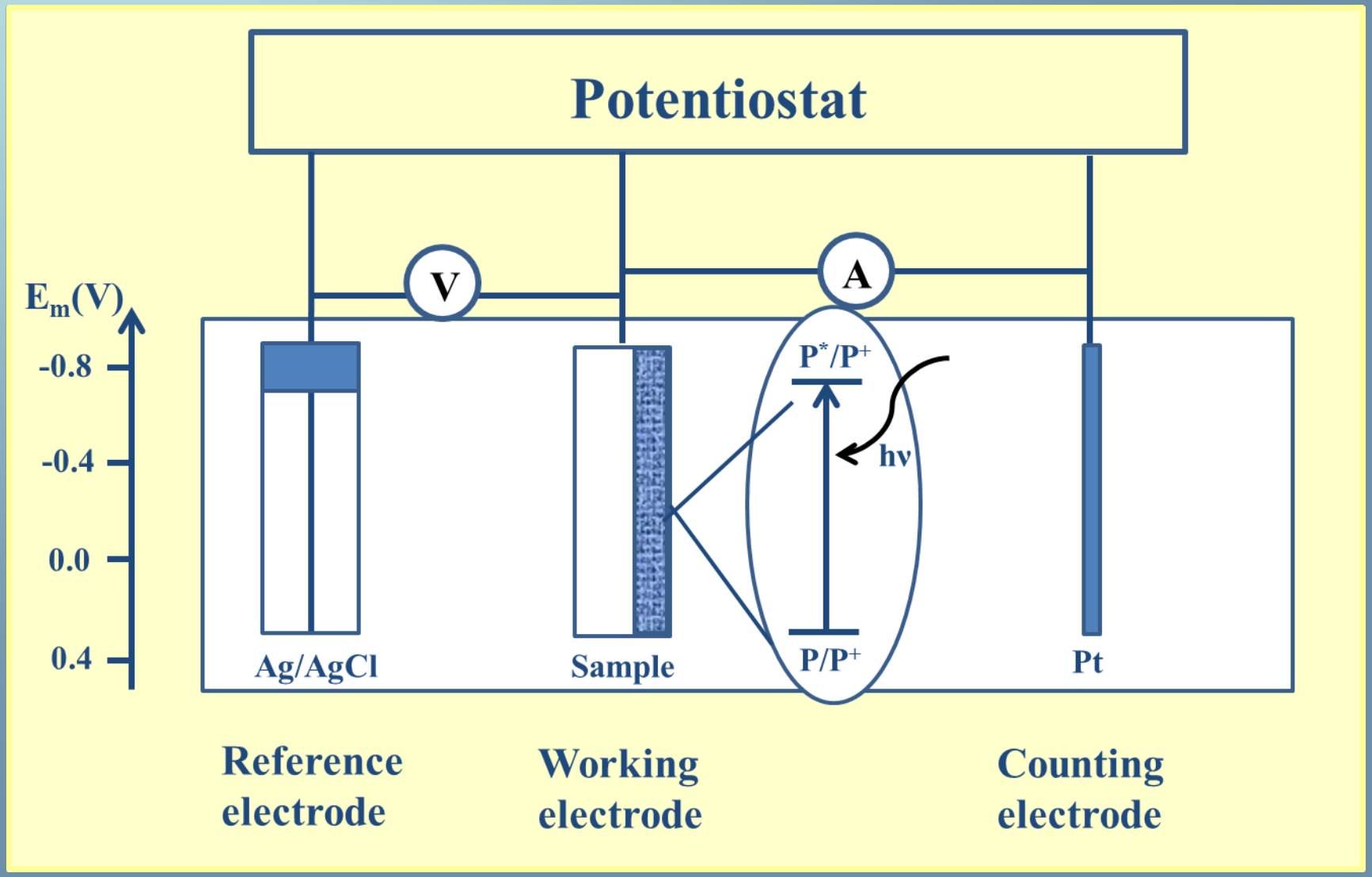
Nickel-complex with carbodiimide activation



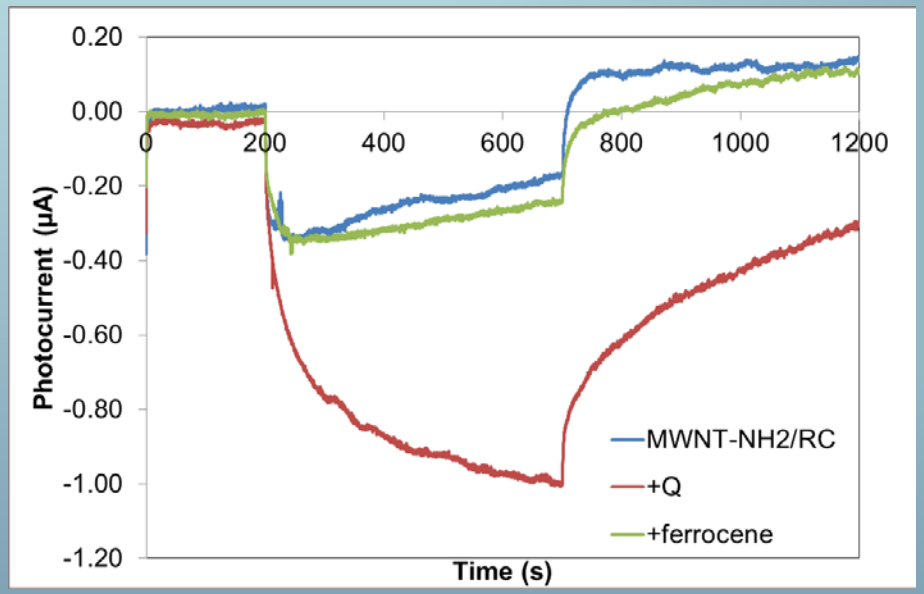
PTAA polymer

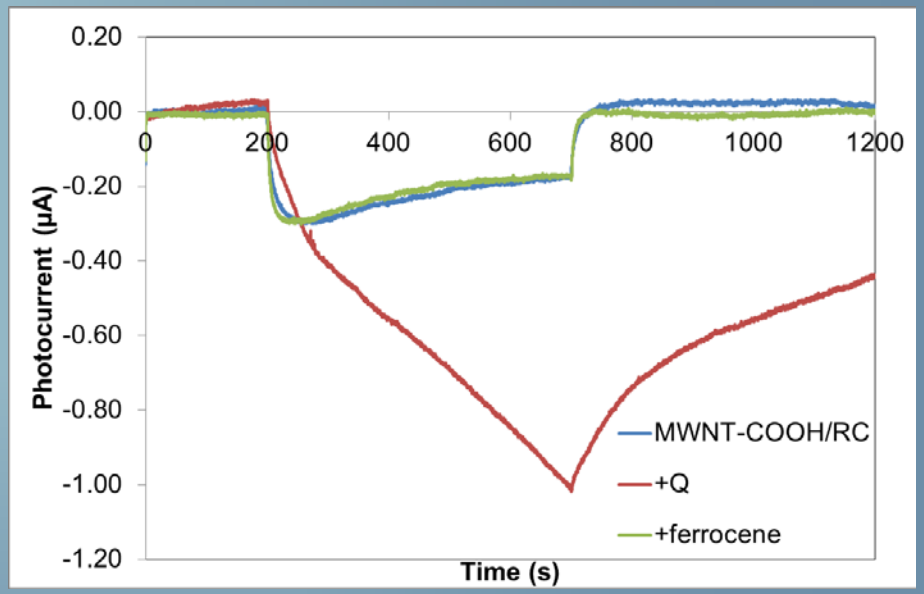
Electrochemical measurements

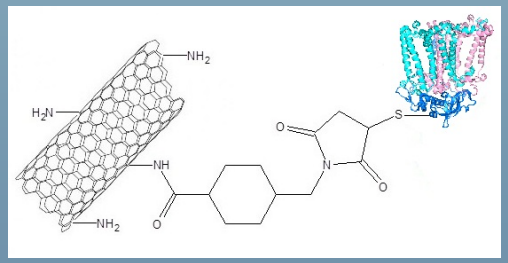
Electrochemical cell



Ligth induced photocurrent in electrochemical cell







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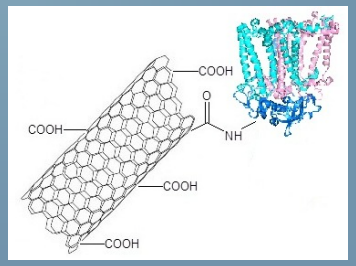

Carbodiimide activation

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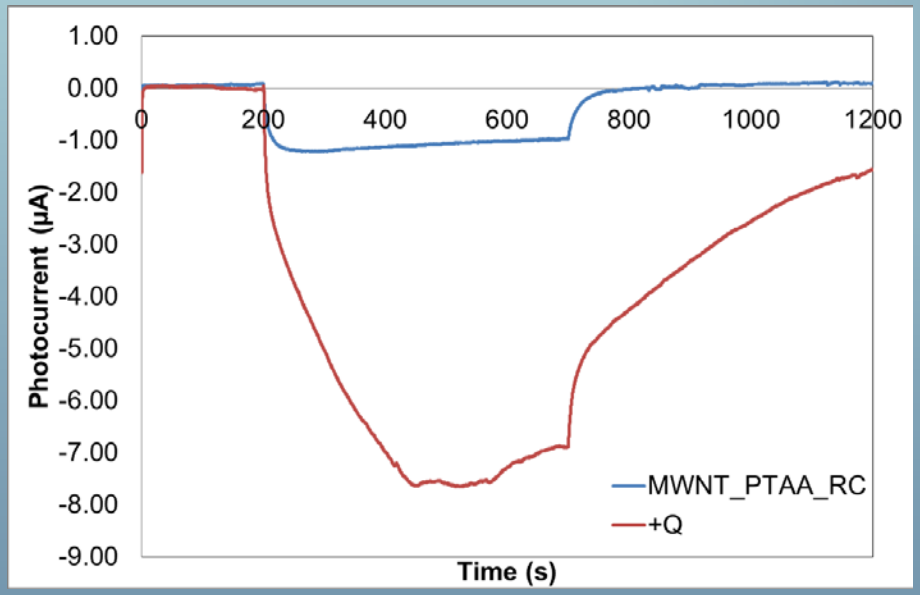
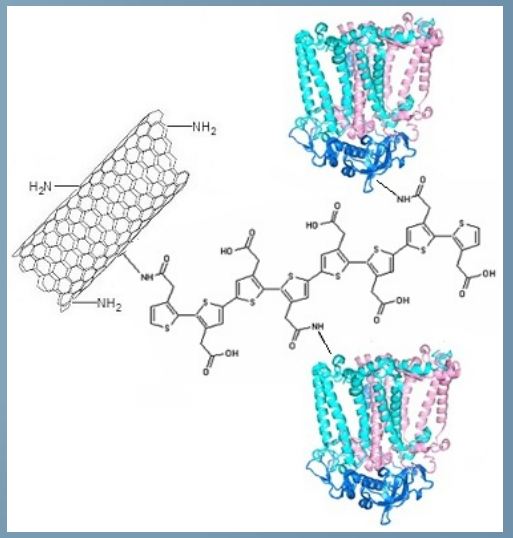


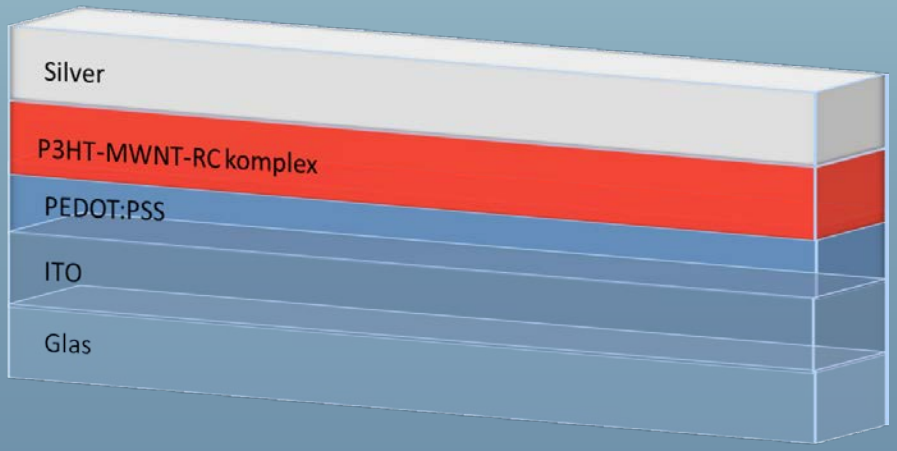


PTAA polymer method

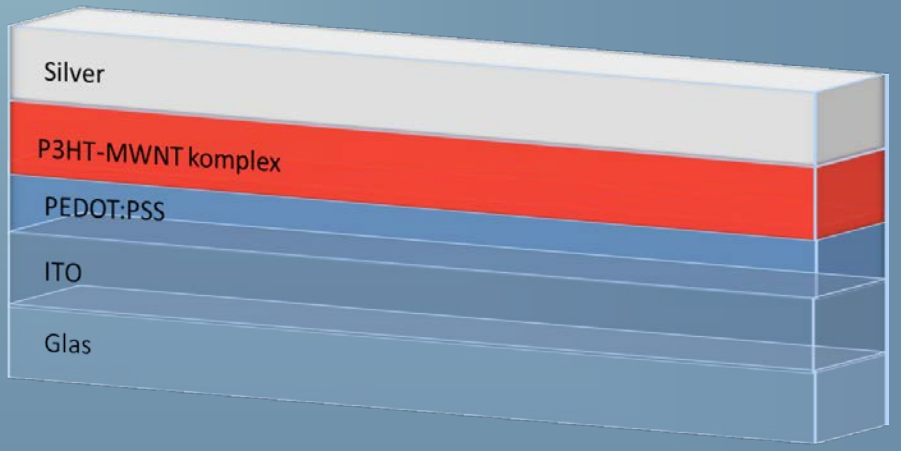
Dried samples

Dried samples

- PEDOT:PSS: electrochemical polimerisation
- P3HT-MWNT-RC komplex: P3HT-MWNT mixed with RC in water solution and dried to the PEDOT:PSS layer

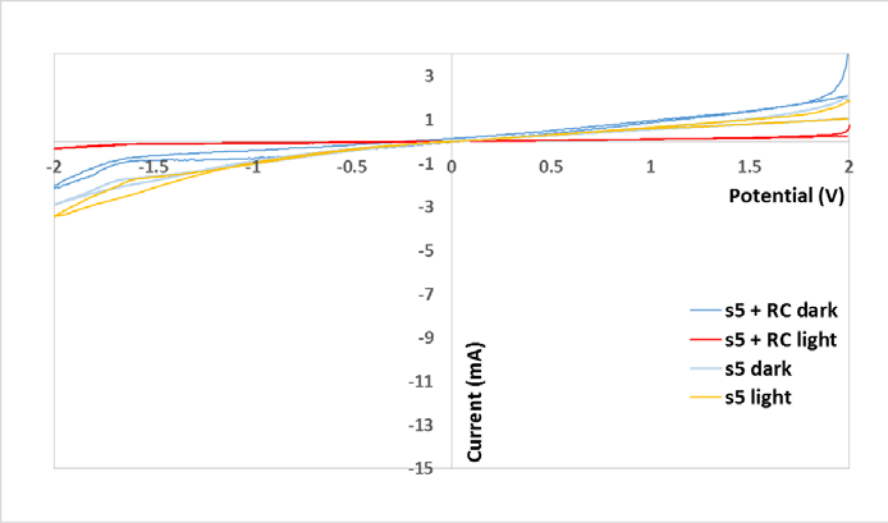


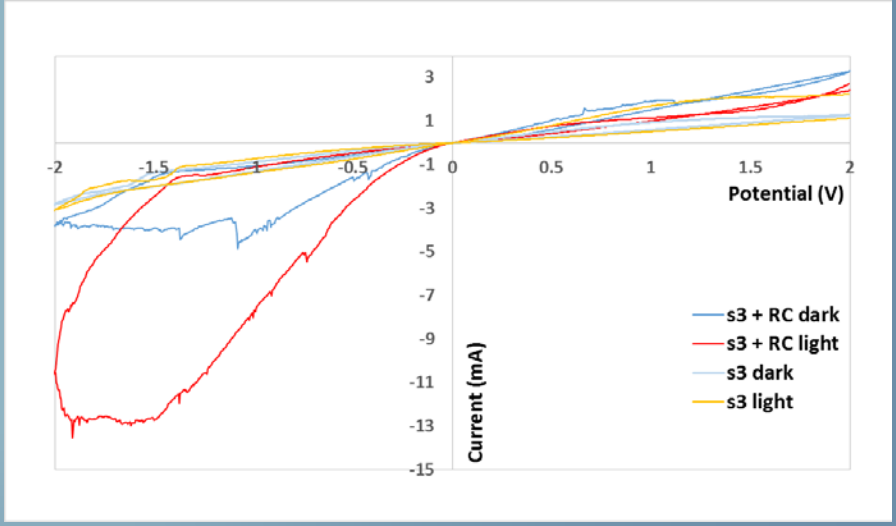
Sample

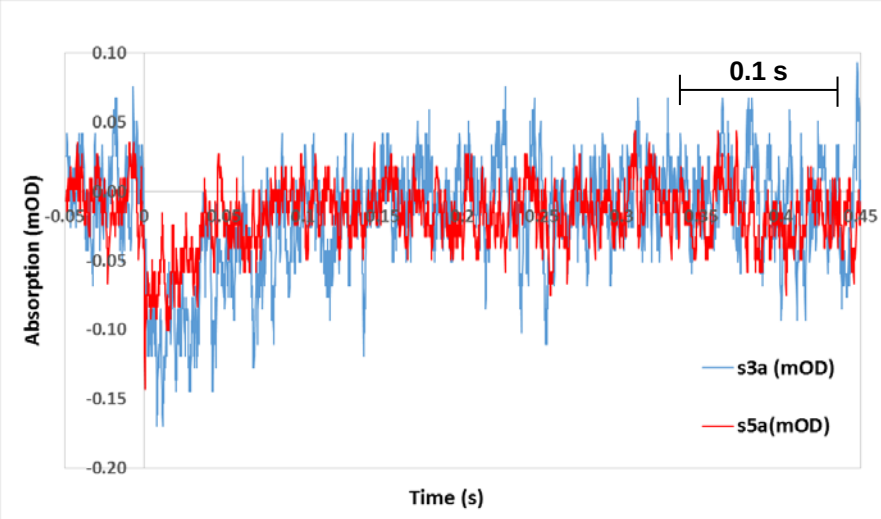


Reference

U-I caracteristics







Summary

- We are able to fix RCs through MWNTs to ITO with different chemical binding methods.
- After the binding RC shows noticeable photoactivity in continuous turnover.
- UQ0 mediator increases the photocurrent.
- Both the amine and carboxy functionalized MWNTs showed considerable photoactivity.
- Using PTAA the photocurrent was even larger.
- We are able to measure light induced photocurrent on dried samples as well

Further investigations

Electrochemeical measurements:

- Efficiency of the system
- Oriented binding
- Other redox mediators
- Spectroelectrochemical measurements
- Other transparent electrodes (CNT, graphene)

Dried samples:

- Optimize the thickness
- Prepare the silver layer by PLD method

Contributors

László Nagy[1], Kata Hajdu[1], Melinda Magyar[1], Emil Nyerki[1], Klára Hernádi[2], László Forró[3], Endre Horváth[3], Arnaud Magrez[3], Krisztina Nagy[4], Zsolt Szegletes[4] György Váró[4], Balázs Endrődi[5], Csaba Visy[5]

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Thank you for your attention!