

# VLIV RŮZNÝCH TYPŮ REAKČNÍCH ČINIDEL NA ÚSPĚŠNOST SANACE STEJNOSMĚRNÝM ELEKTRICKÝM POLEM

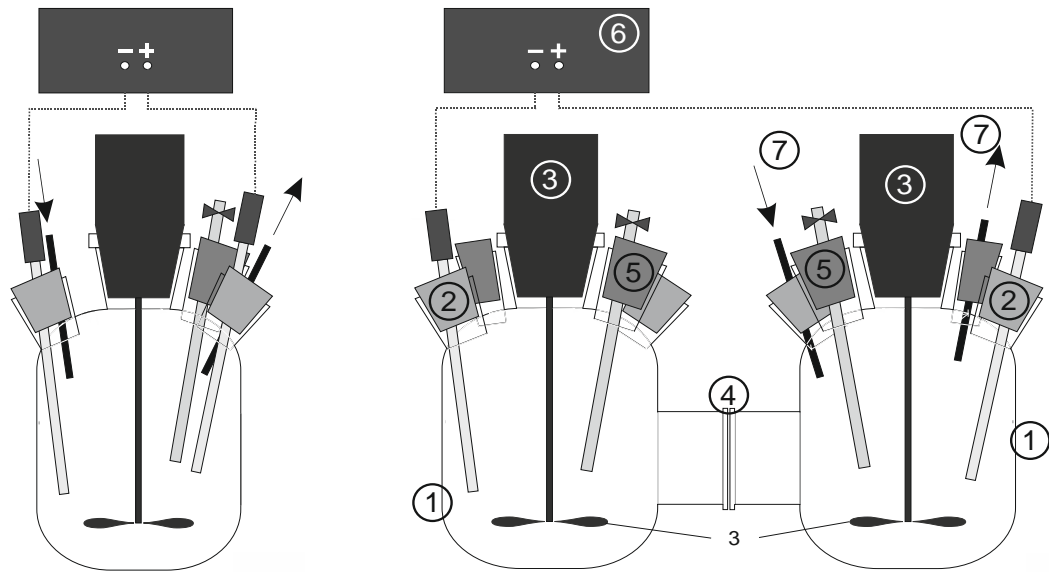
VENDULA CENCEROVÁ, JAROSLAV NOSEK,  
JAROSLAV HRABAL

Znečistené územia, Piešťany 19.-21. 6. 2019



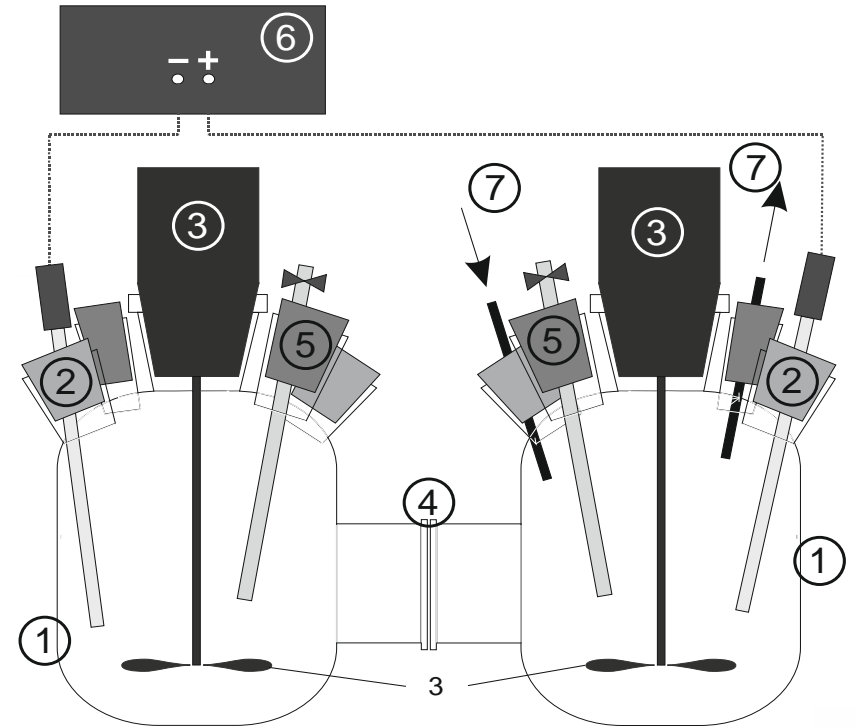
# METODIKA REAKTOROVÝCH TESTŮ

- studium degradace ClU při různém typu zapojení reaktorů v reálné vodě
- reakční činidlo nZVI NANOFER STAR
- Cíl testů: porovnat průběh vzniku koncových produktů dechlorace a studium vlivu elektrického proudu na dechloraci ClU.



Obr: a) Blokové schéma reaktoru se zavedenými elektrodami v kombinovaném uspořádání; b) dvojitý reaktor oddělený iontovou membránou ; c) Fotografie dokumentující průběh reaktorových testů s nZVI a DC – kombinované uspořádání. Autor: TUL.

# METODIKA REAKTOROVÝCH TESTŮ





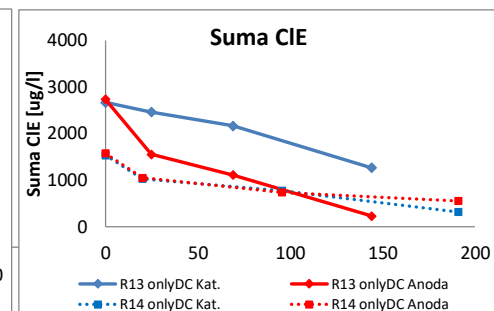
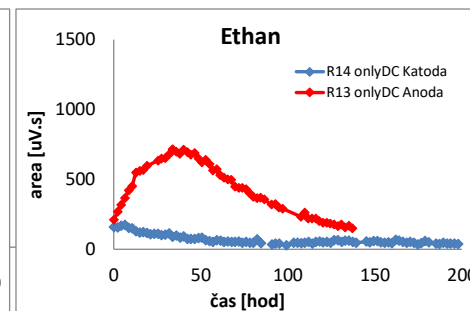
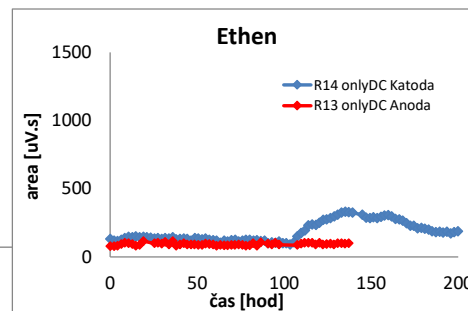
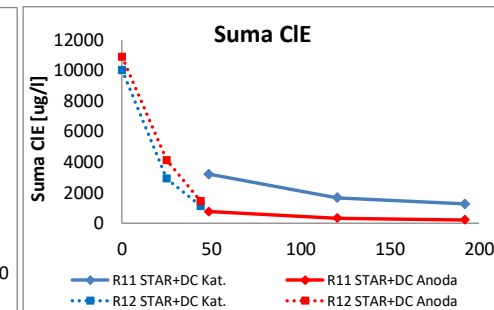
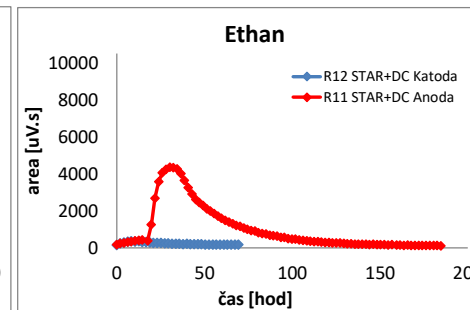
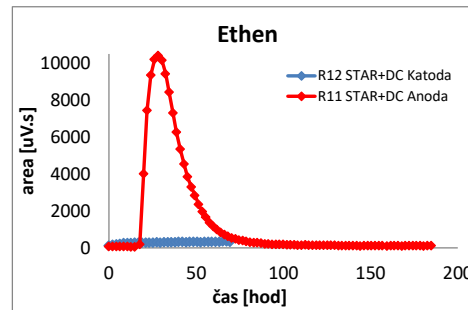
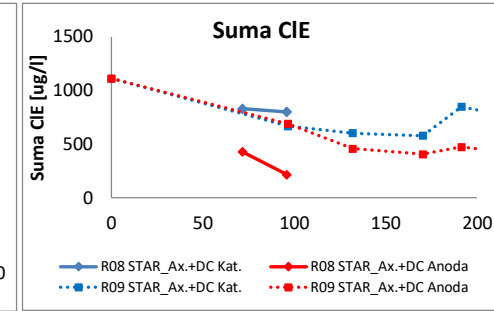
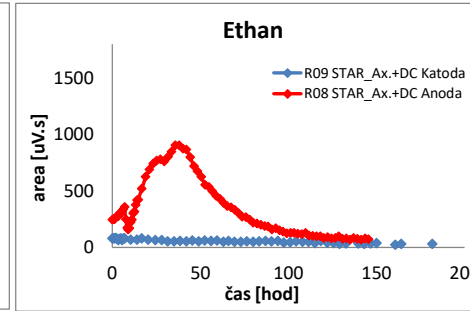
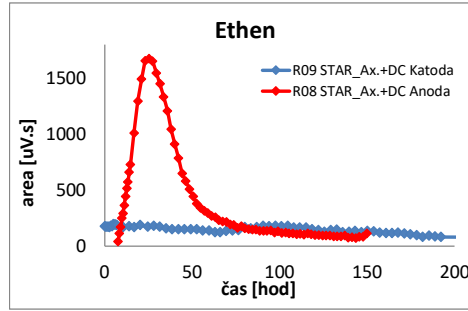
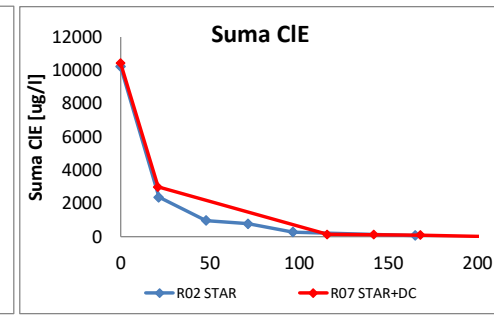
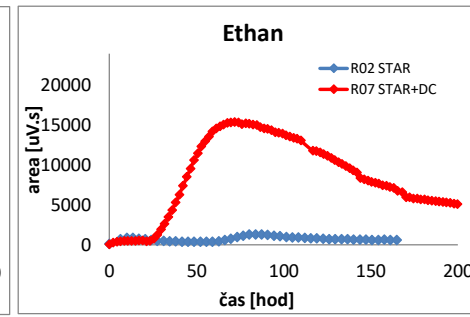
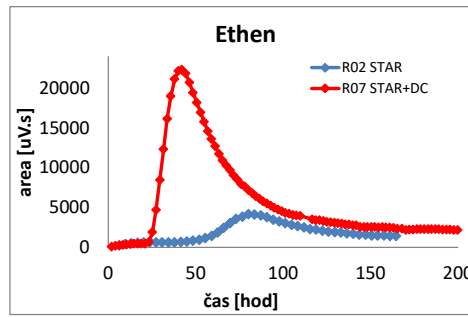
# VÝSLEDKY TESTŮ

## Kombinované uspořádání reaktorů

- R02 - nZVI NANO FER STAR Ax
- R07 - NANO FER STAR Ax + DC

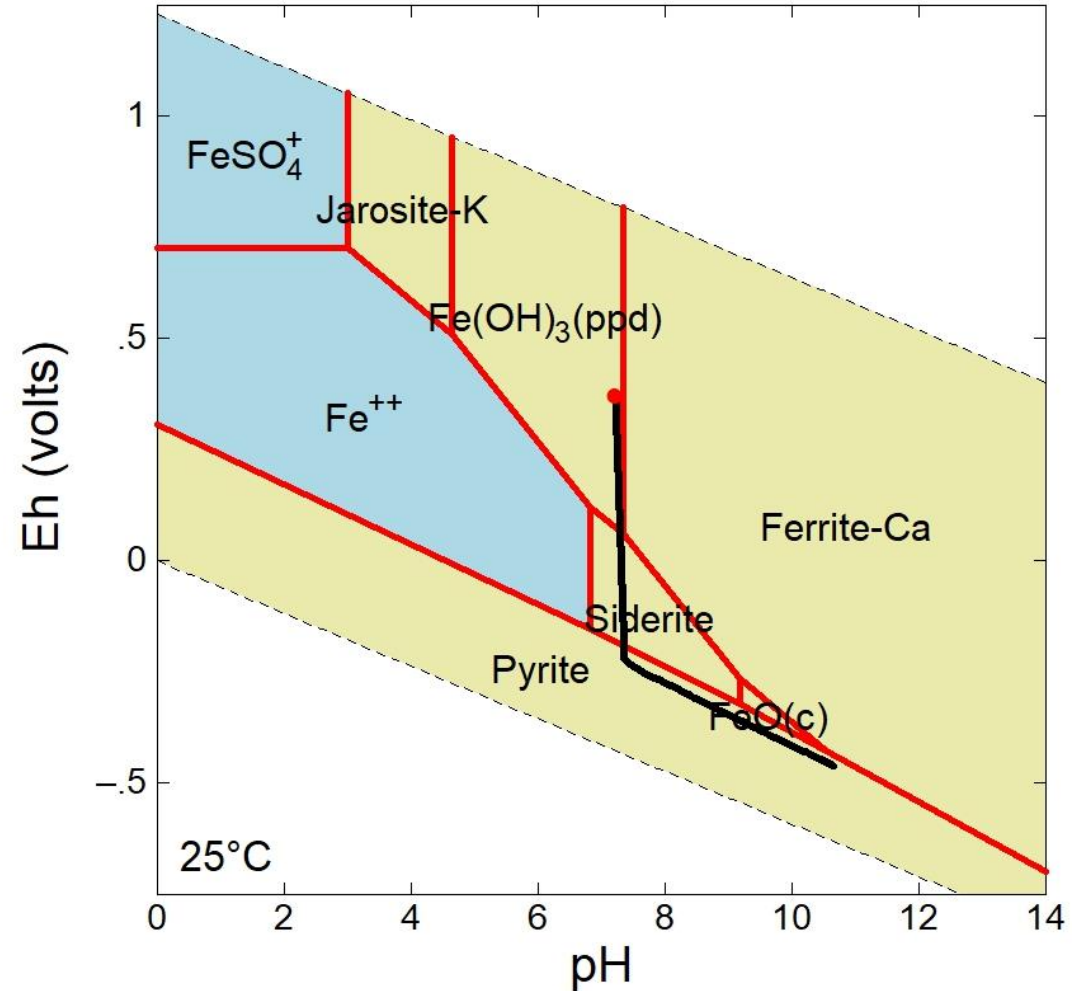
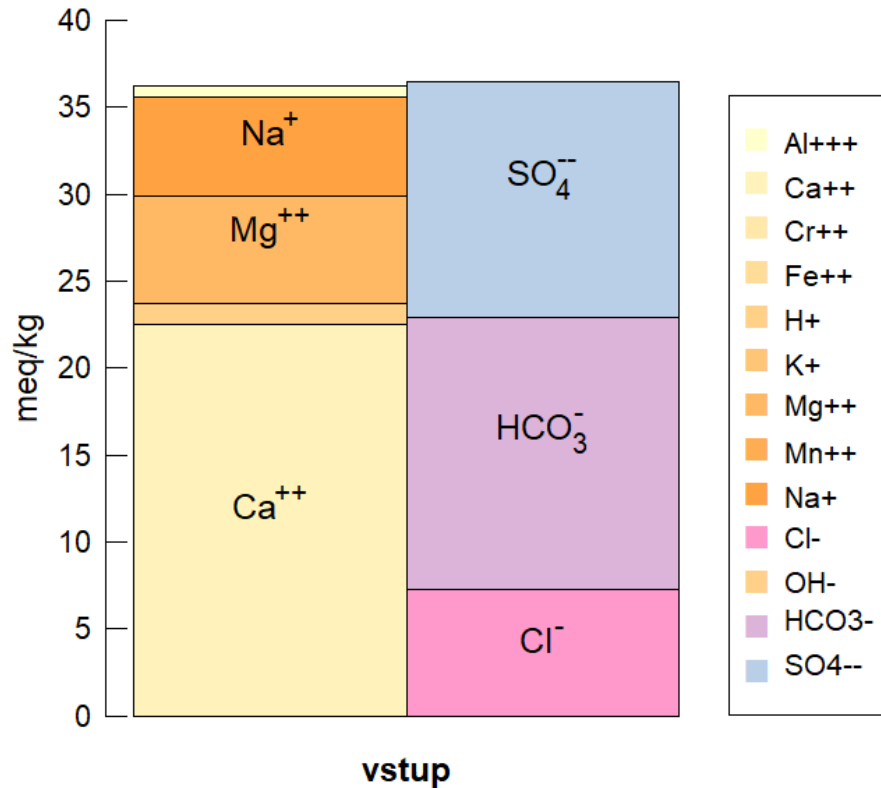
## Oddělené uspořádání reaktorů

- R08, R09 – NANO FER STAR Ax. + DC
- R11, R12 – NANO FER STAR + DC
- R13, R14 - DC

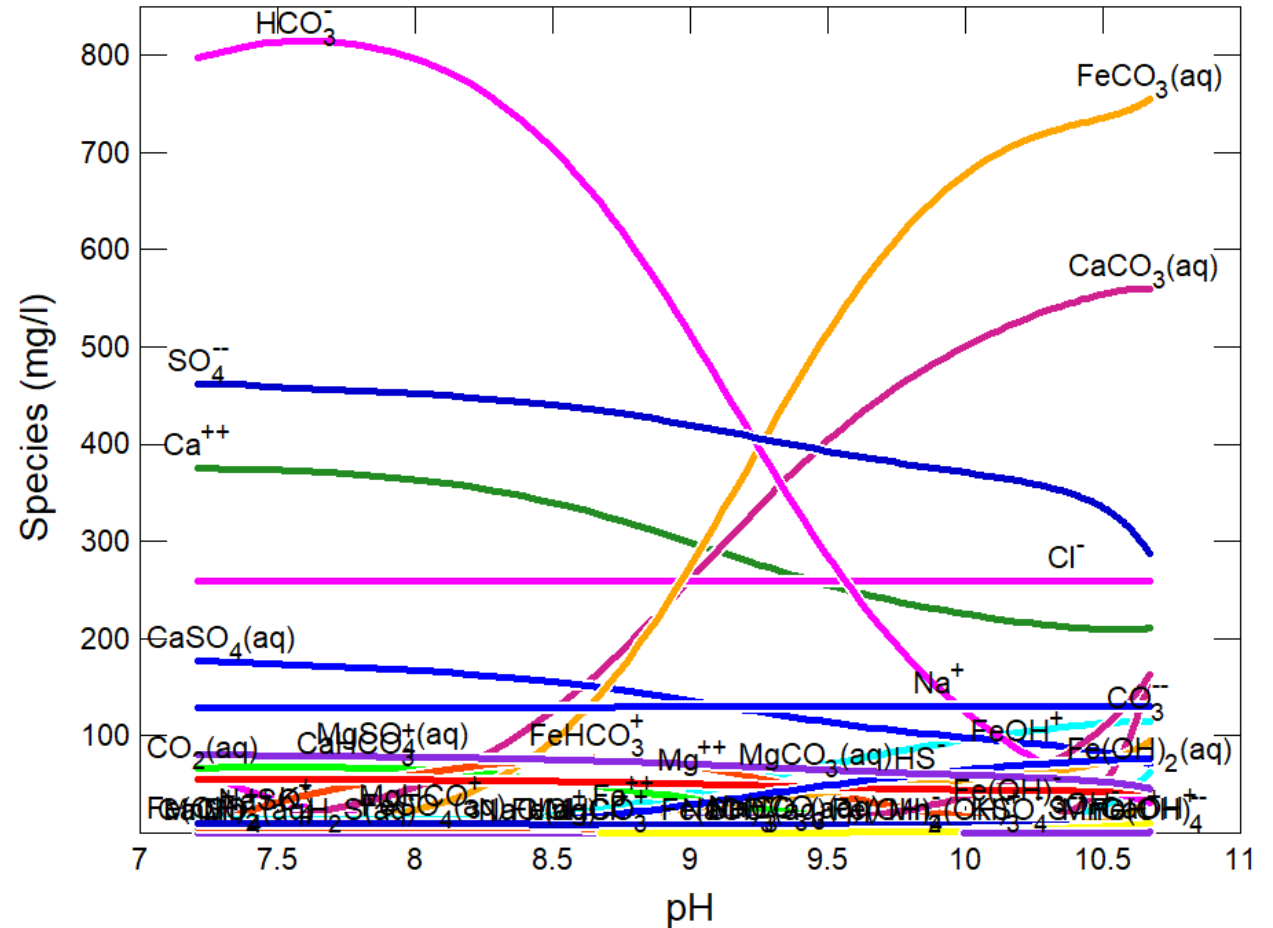
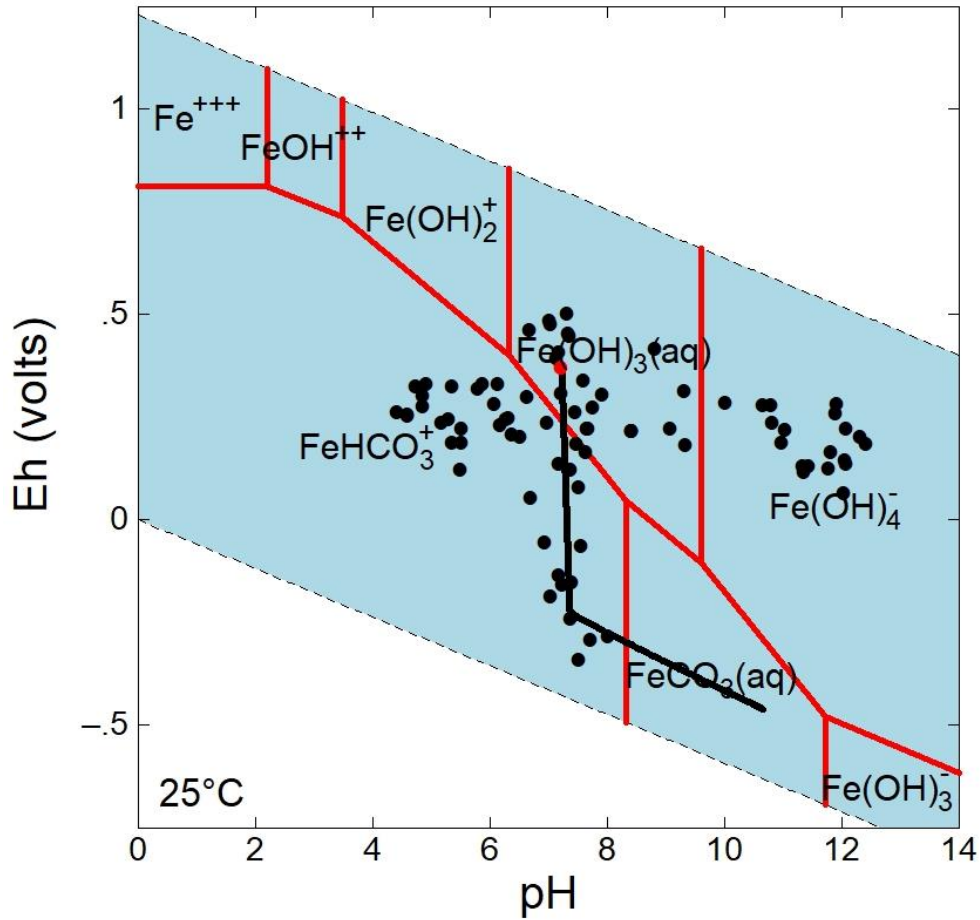


# VÝSLEDKY TESTŮ – geochemický model

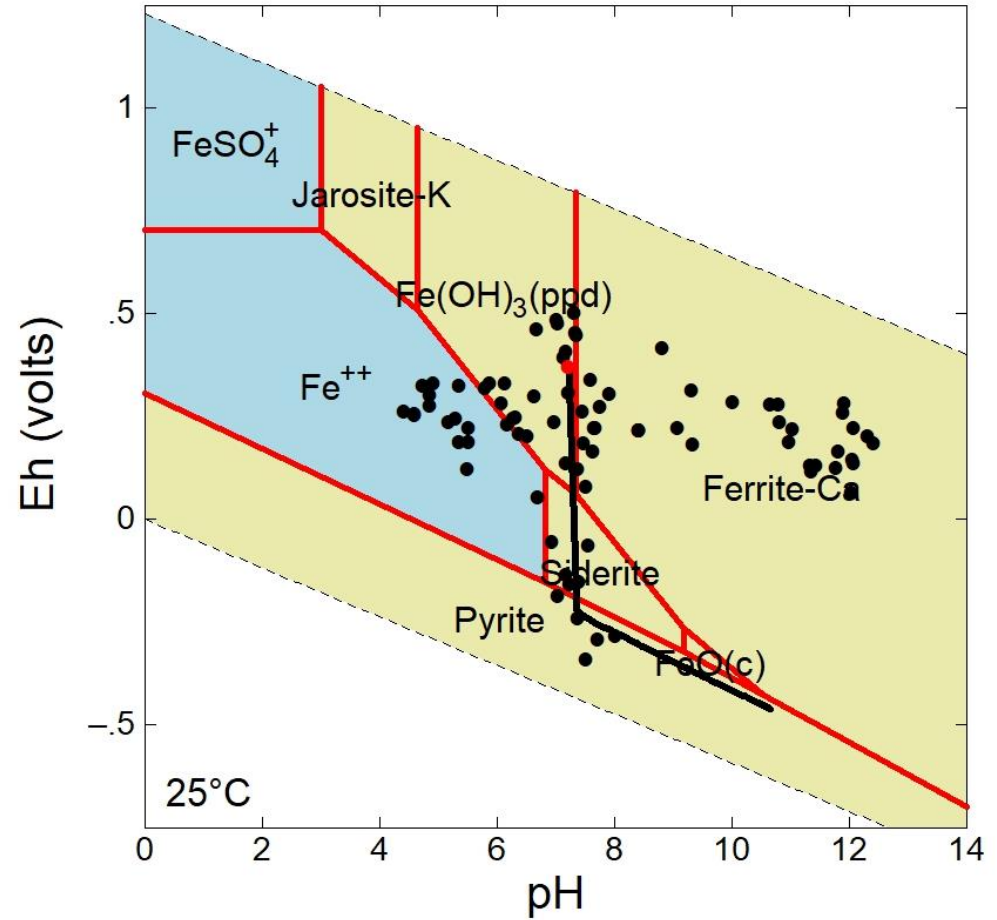
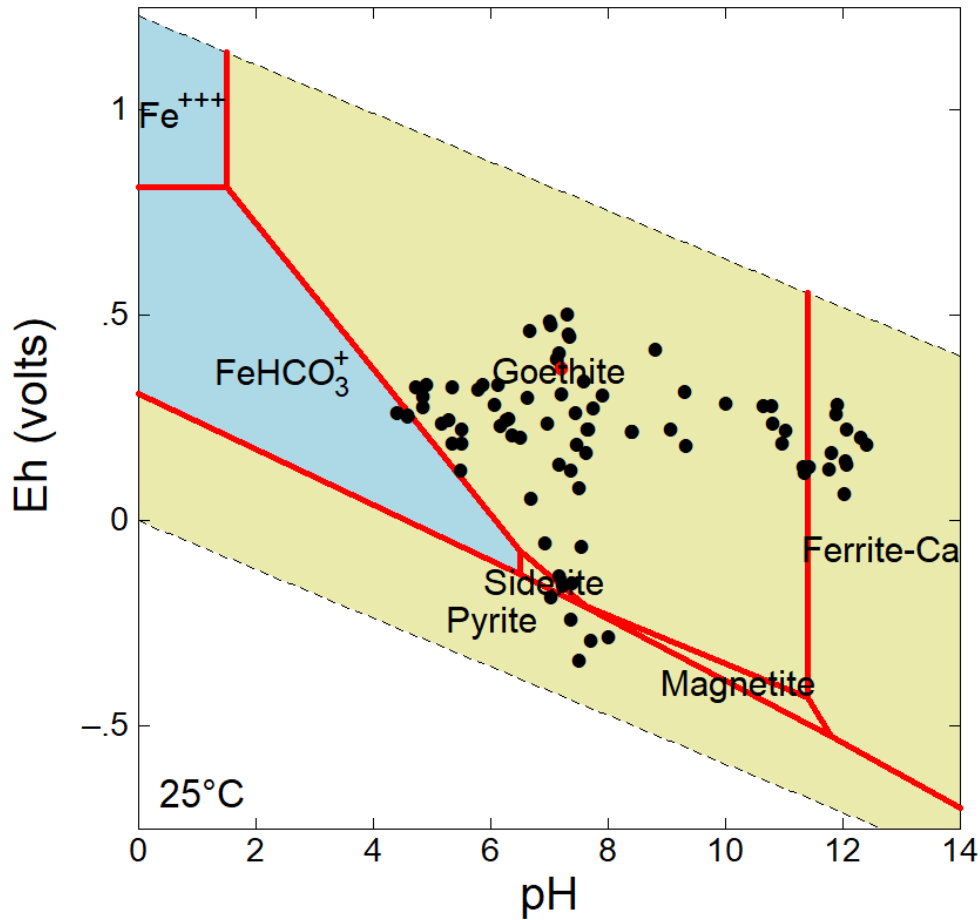
- Aplikace nZVI – 0,64 g/L



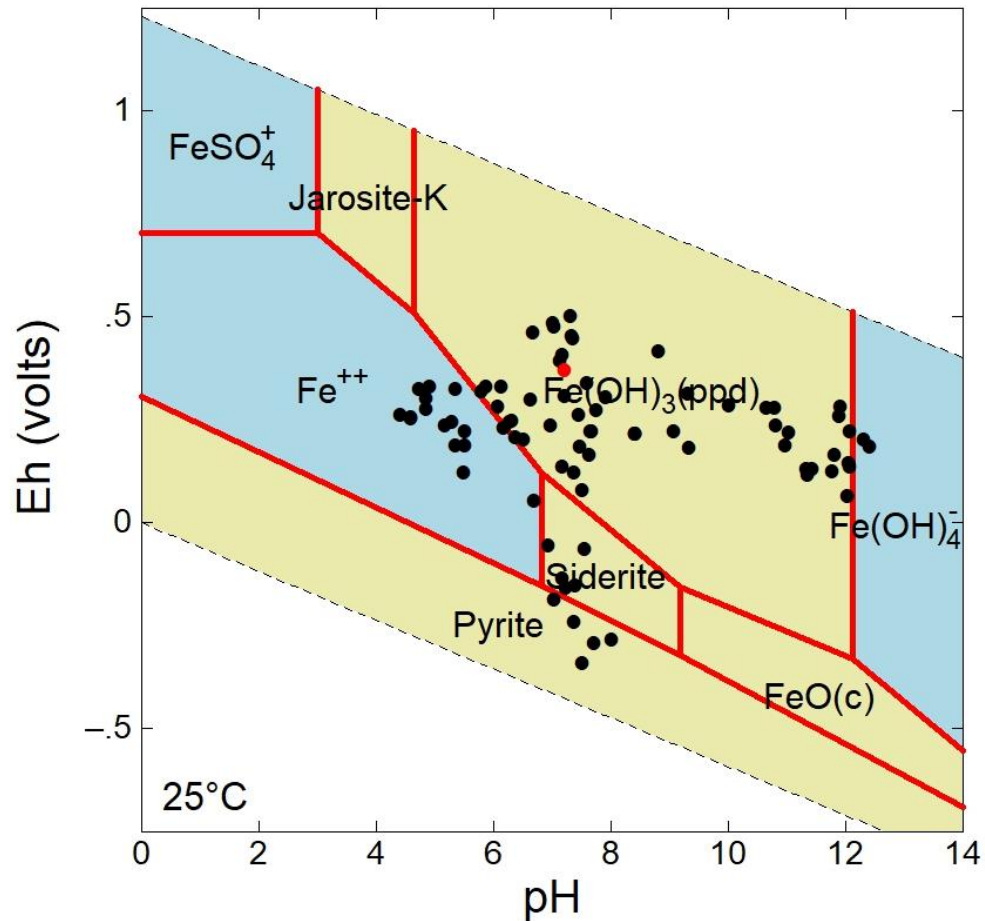
# GEOCHEMICKÝ MODEL – VSTUP, REAKČNÍ CESTA



# GEOCHEMICKÝ MODEL - REAKČNÍ CESTA

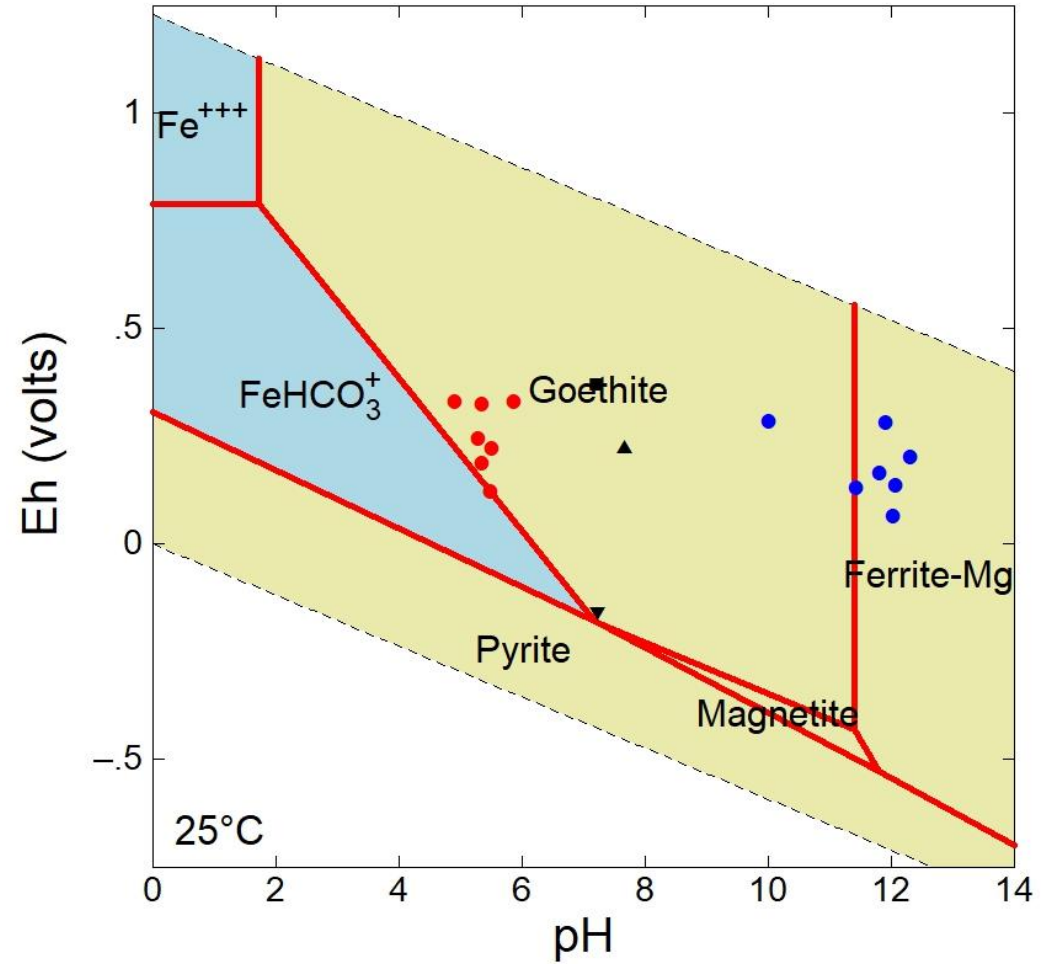
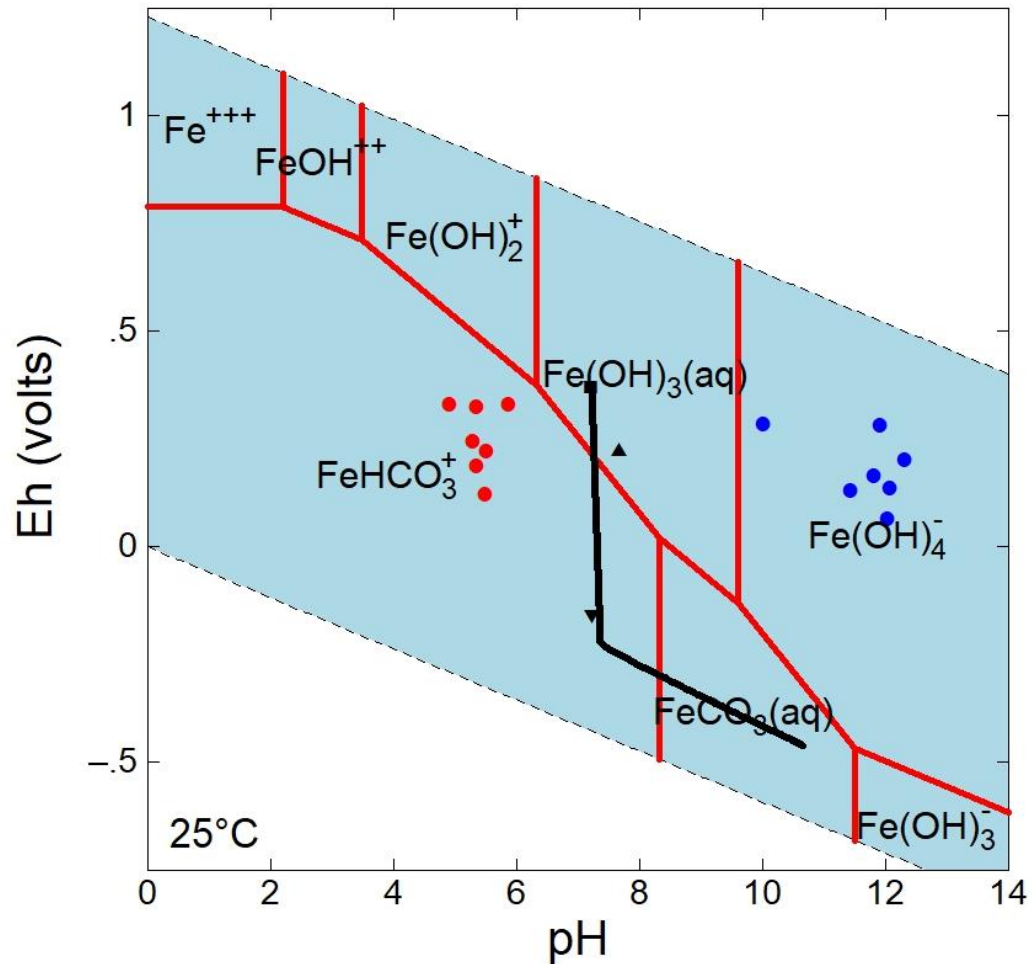


# GEOCHEMICKÝ MODEL – REAKČNÍ CESTA

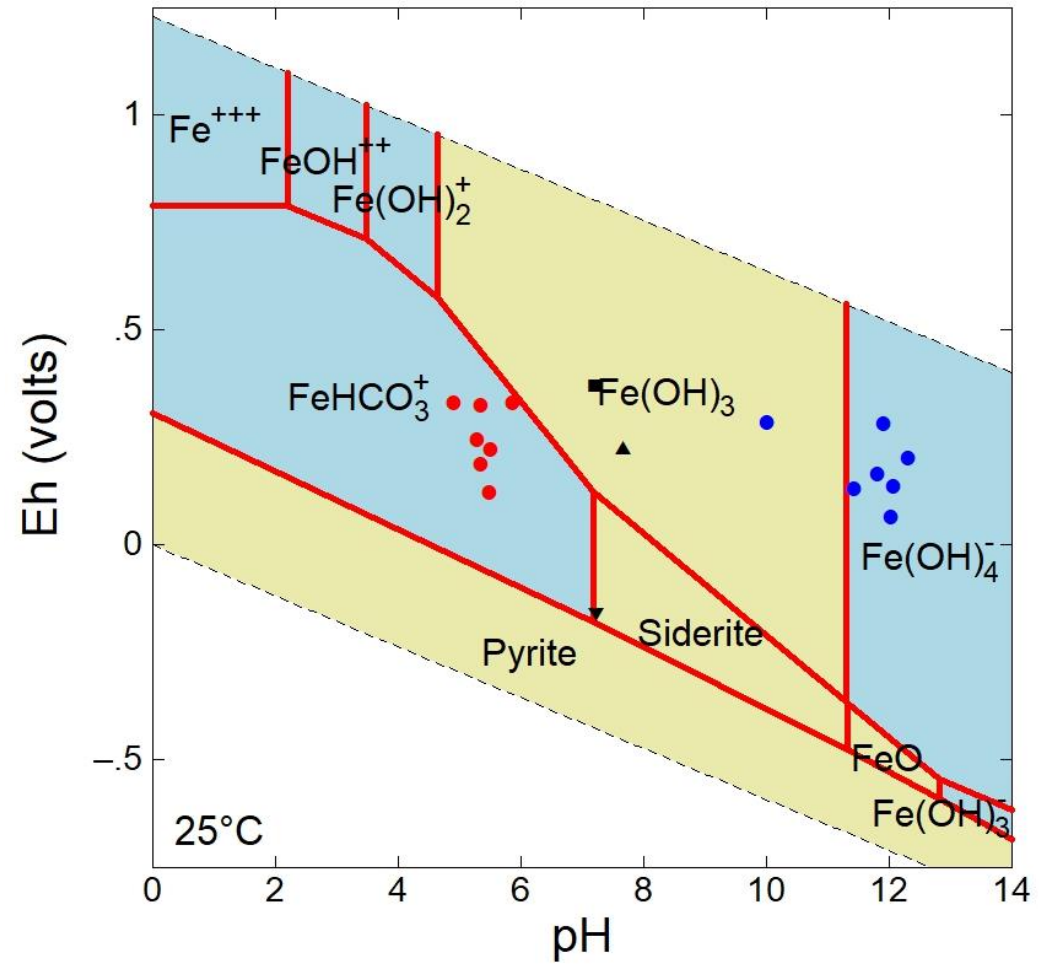
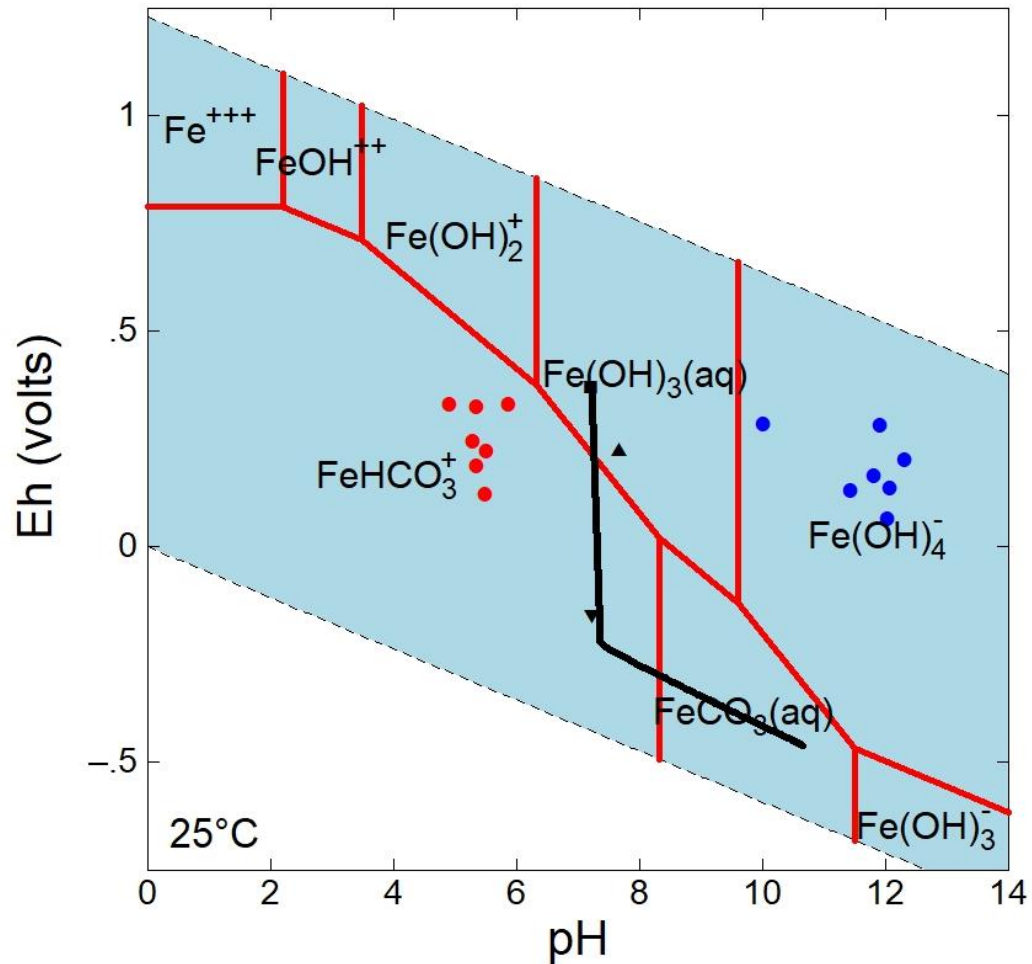




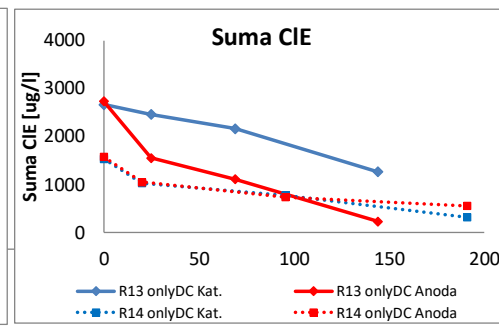
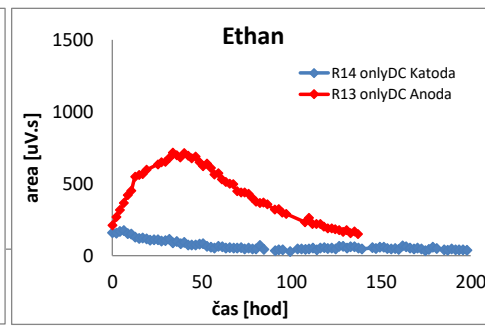
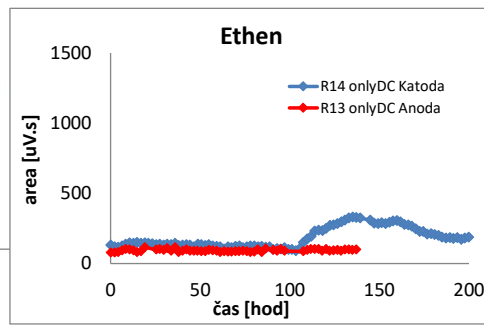
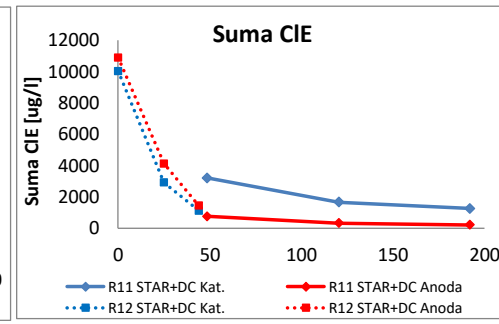
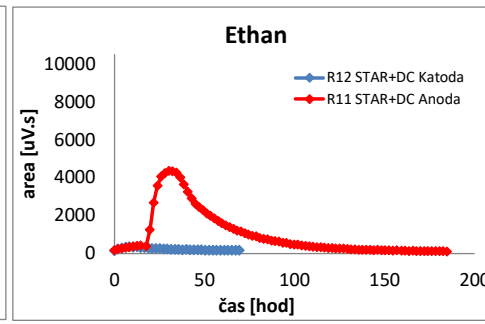
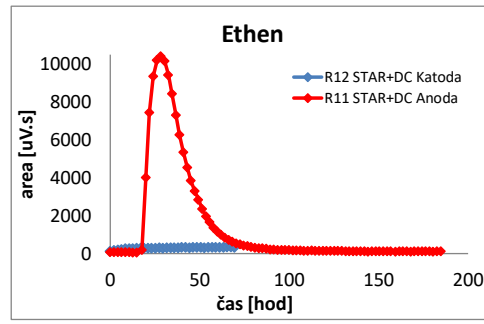
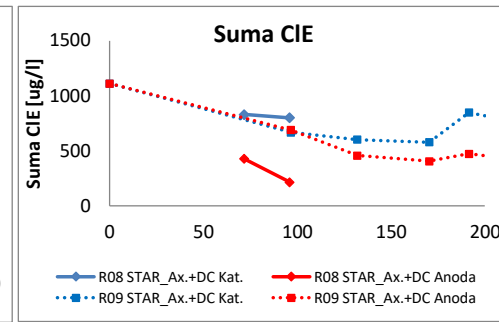
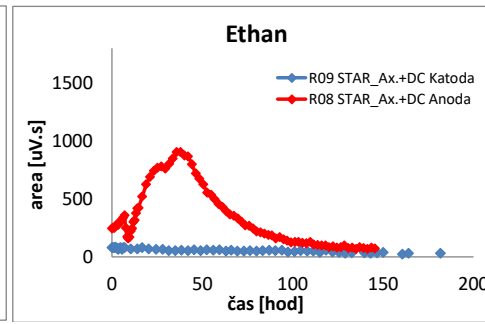
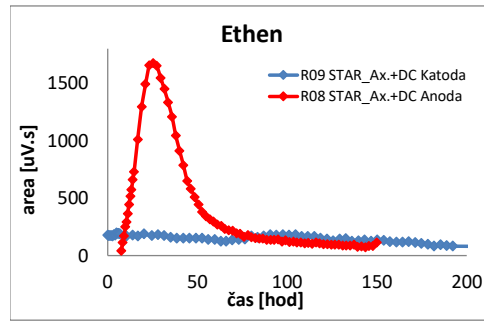
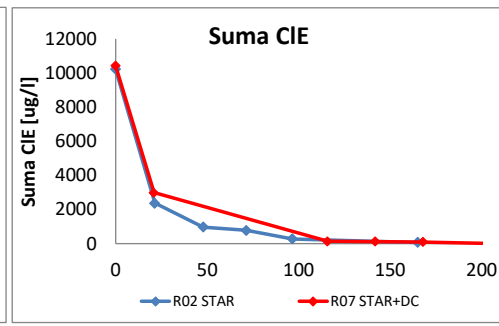
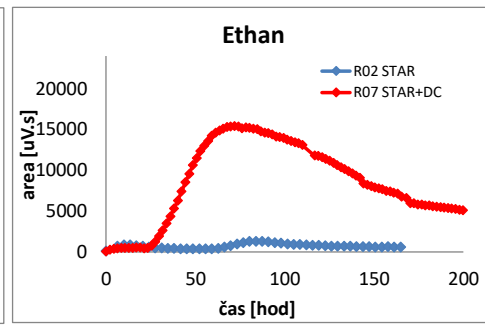
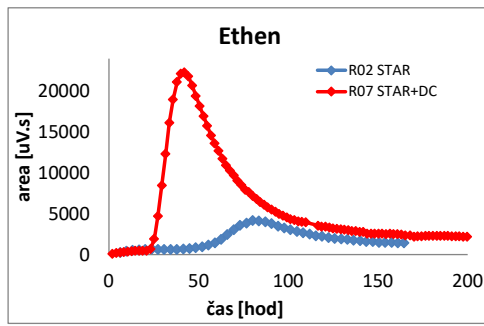
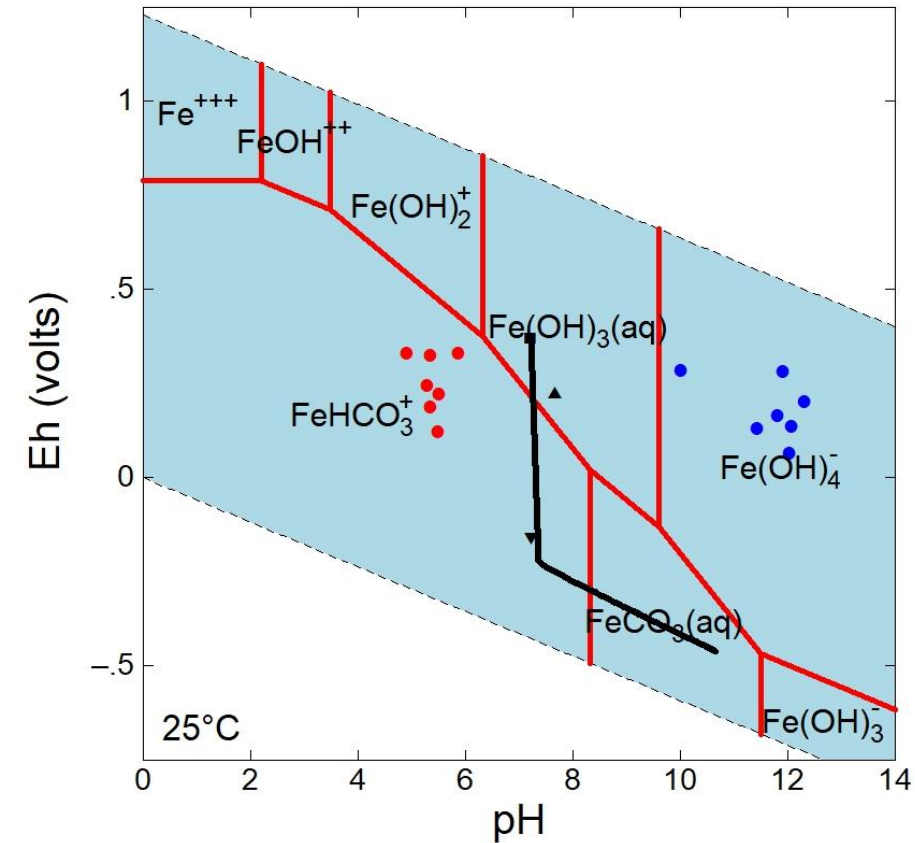
# GEOCHEMICKÝ MODEL – KONEC REAKCE



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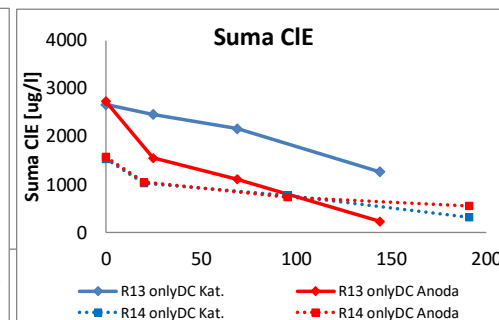
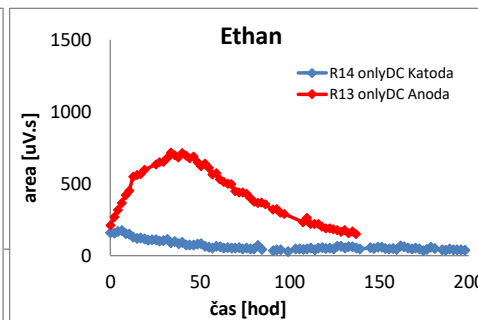
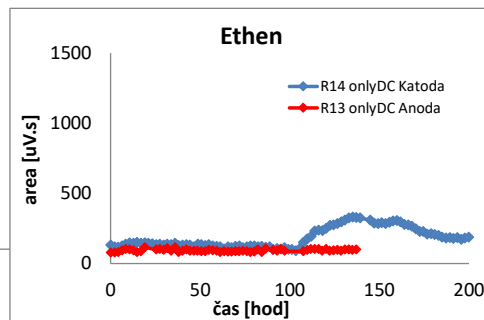
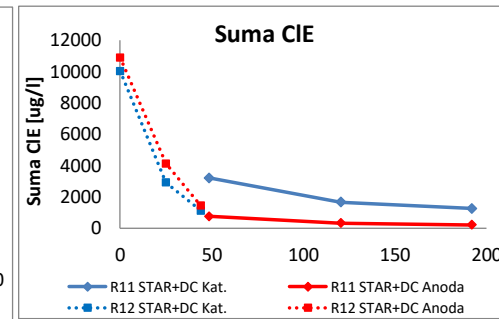
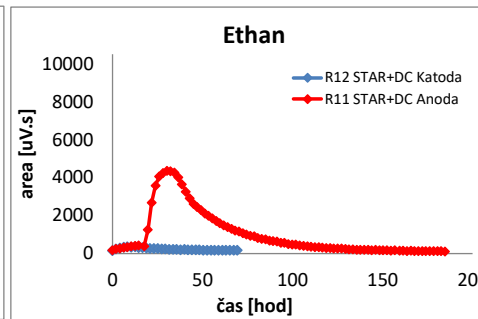
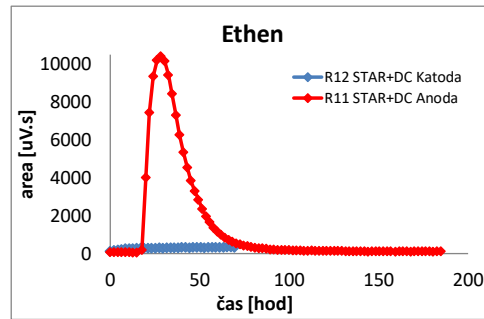
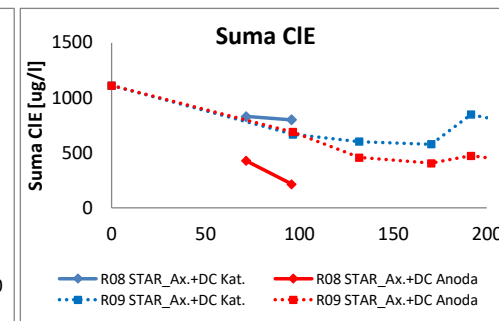
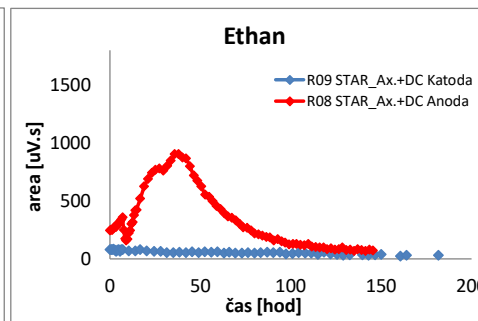
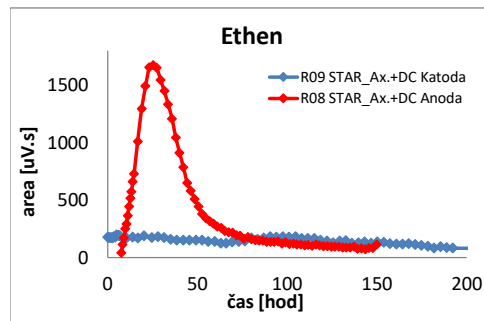
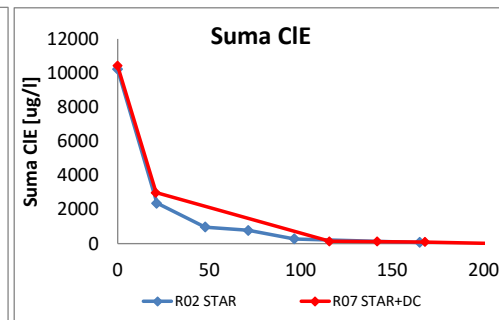
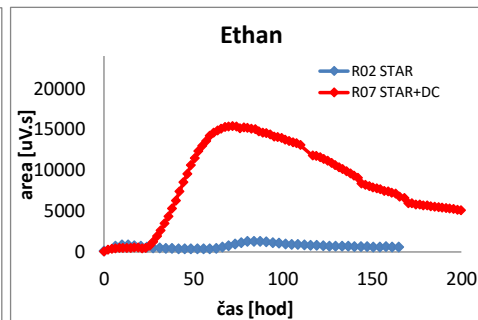
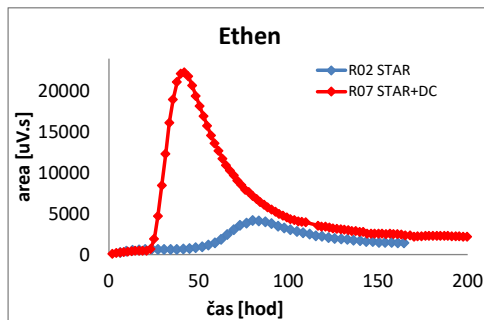
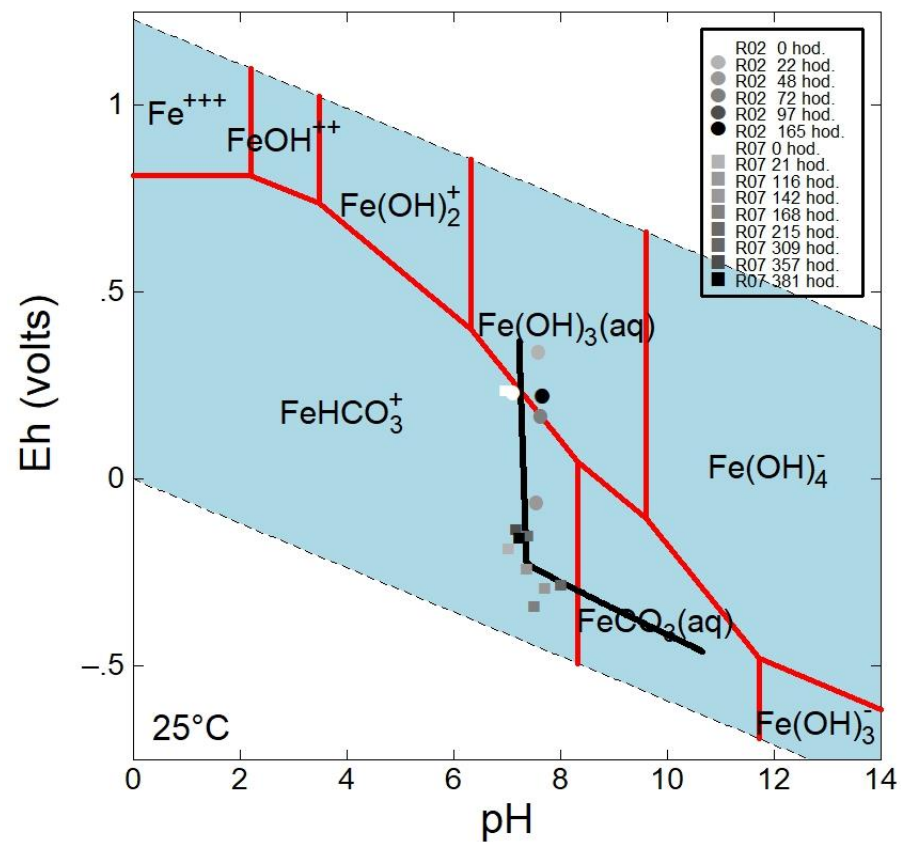
# VÝSLEDKY TESTŮ



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## Kombinované uspořádání reaktorů

- R02 - nZVI NANO FER STAR Ax
- R07 - NANO FER STAR Ax + DC

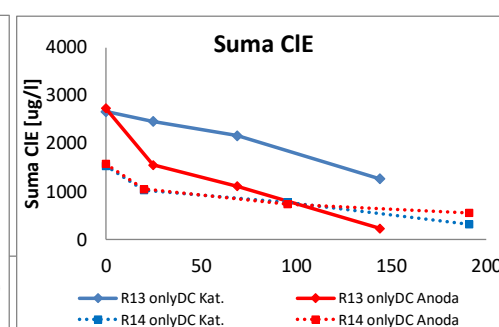
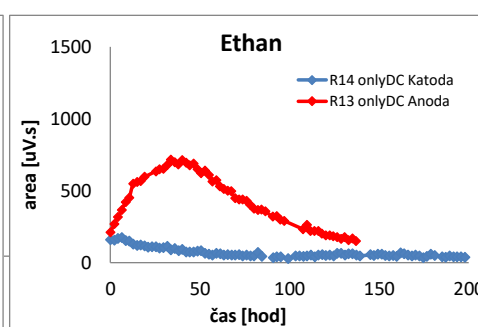
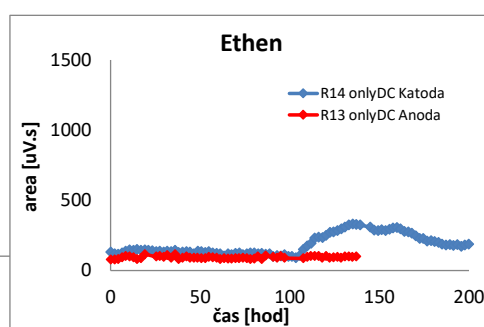
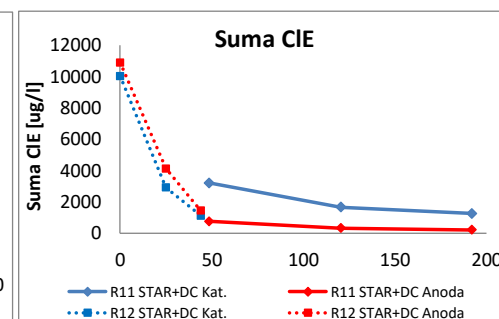
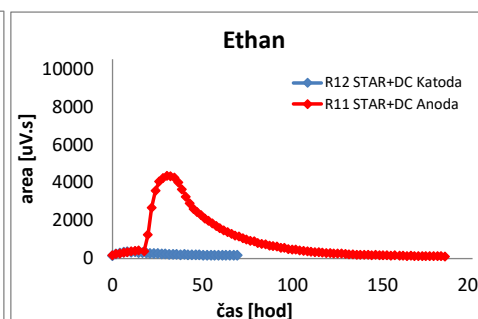
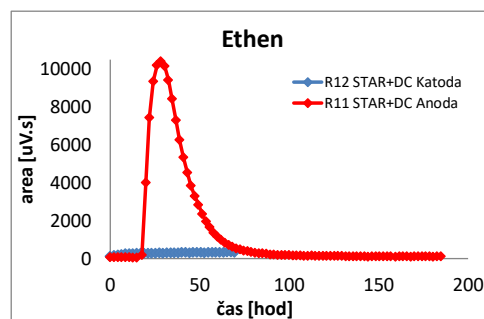
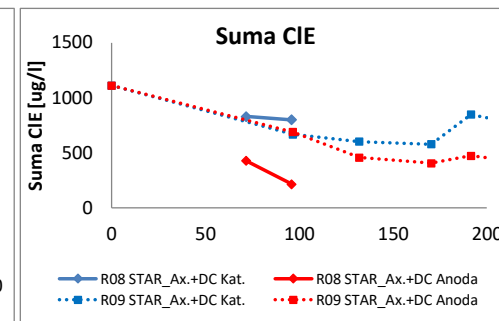
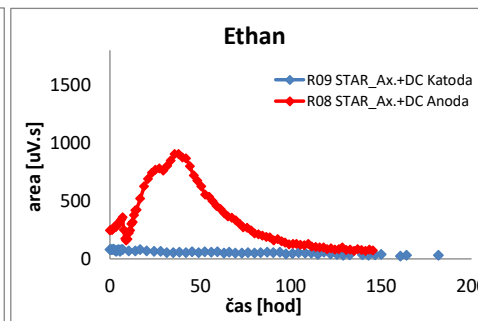
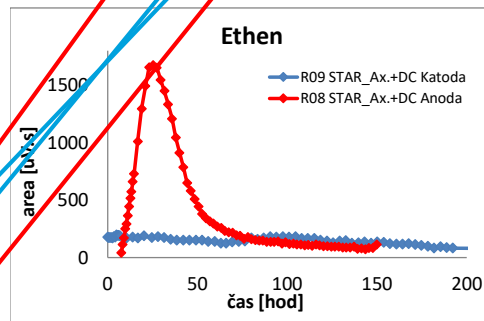
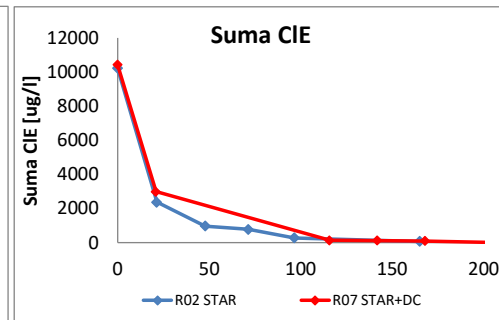
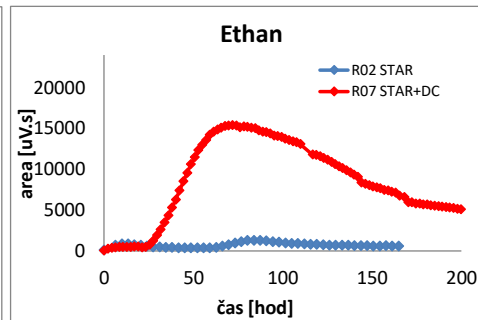
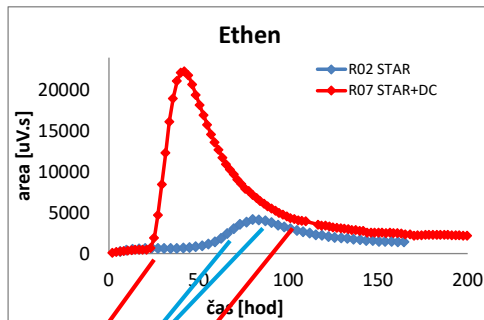
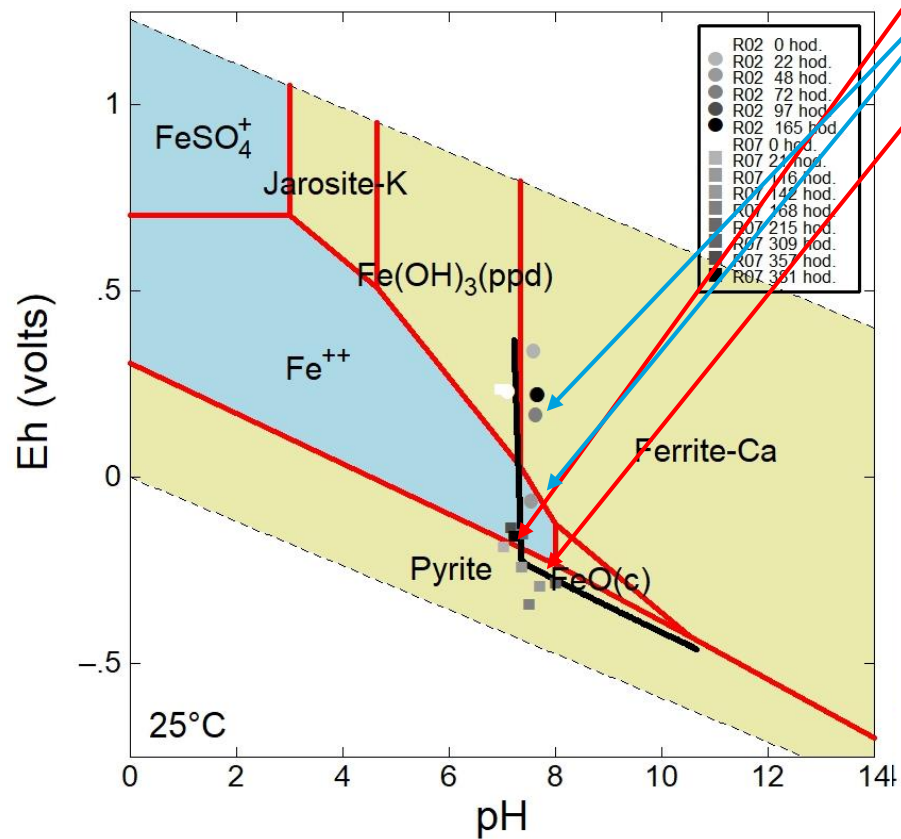




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## Kombinované uspořádání reaktorů

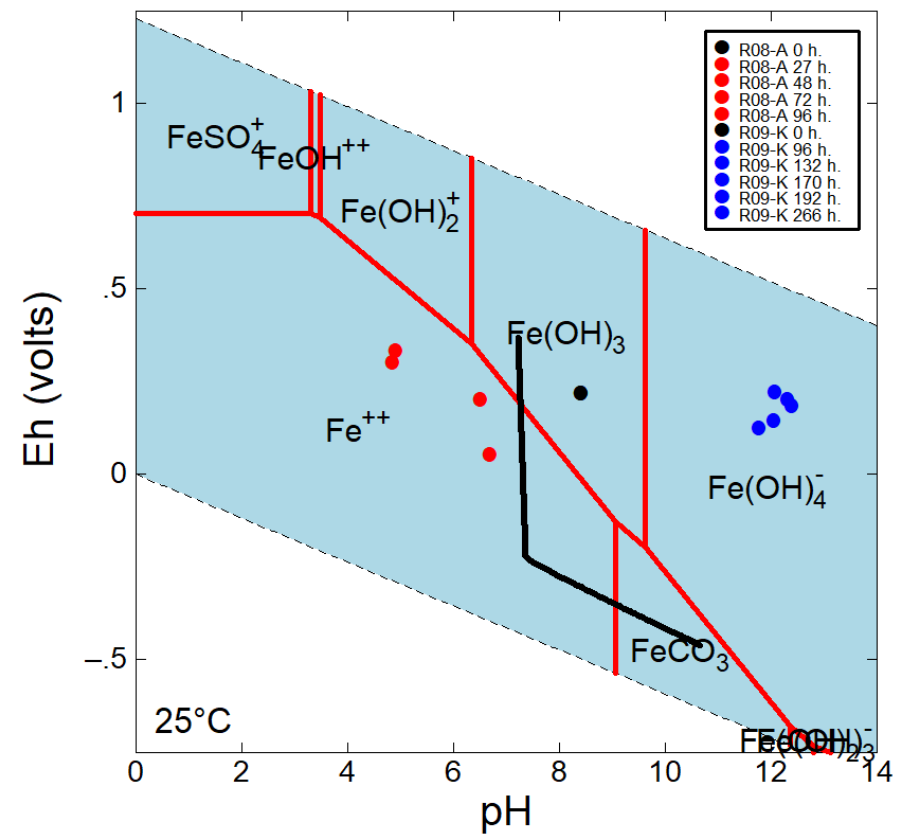
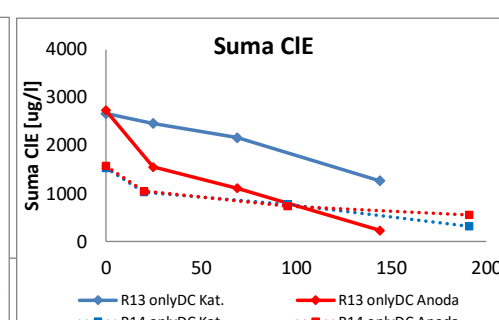
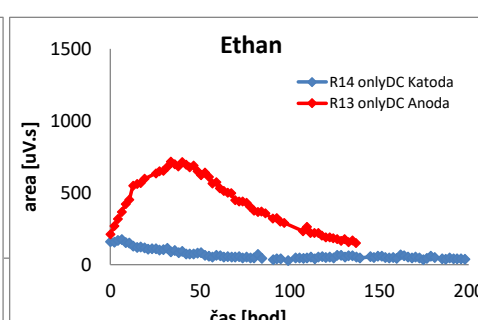
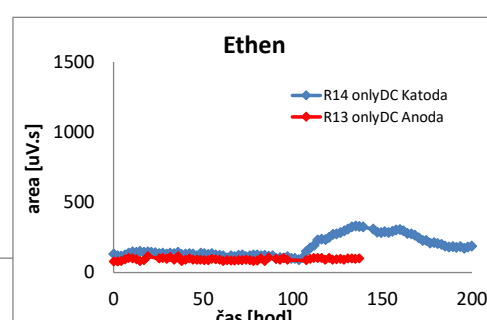
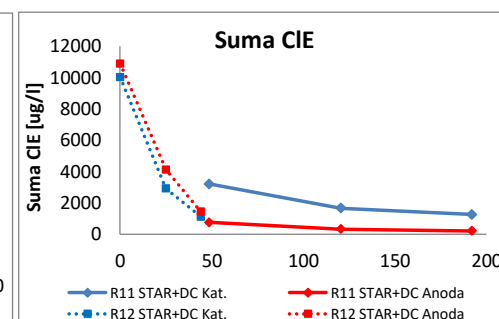
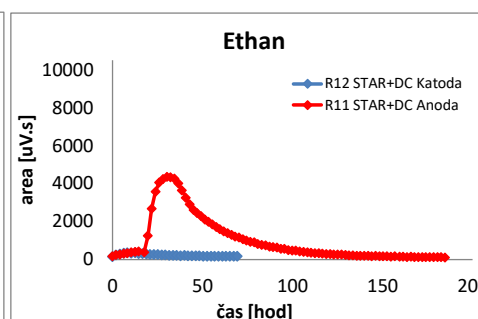
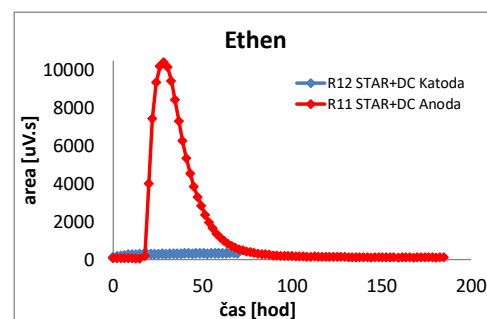
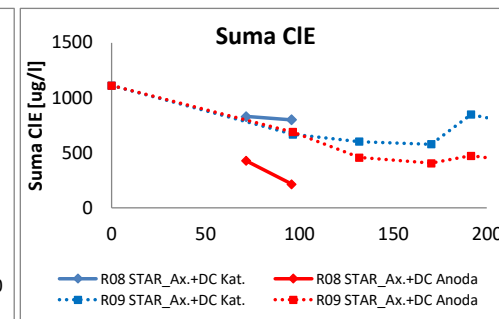
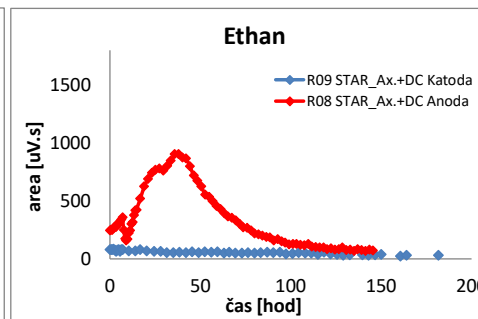
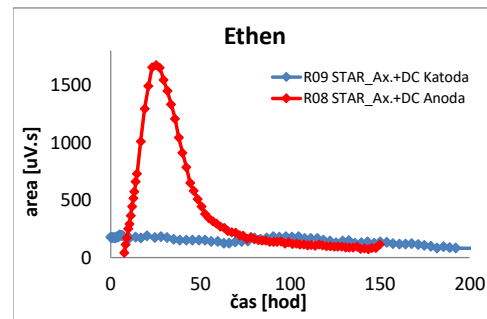
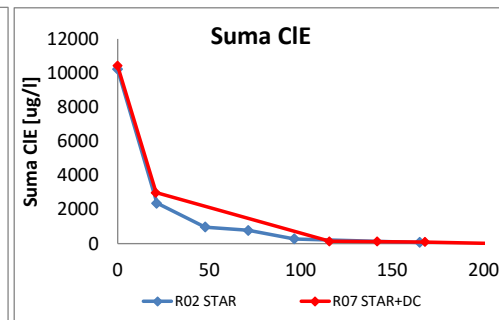
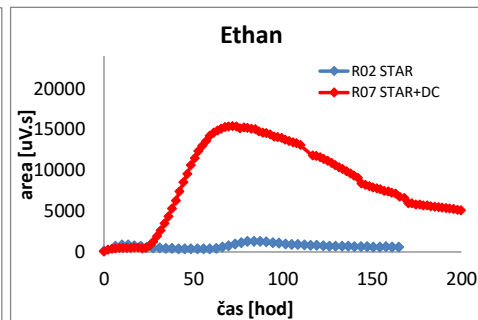
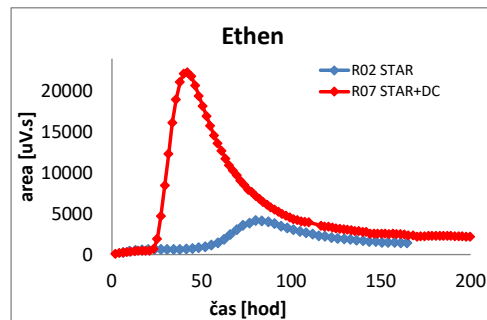
- R02 - nZVI NANO FER STAR Ax
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# VÝSLEDKY TESTŮ

## Oddělené uspořádání reaktorů

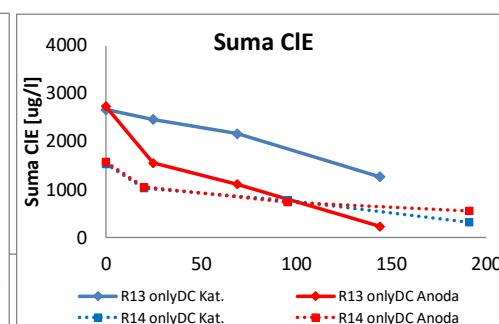
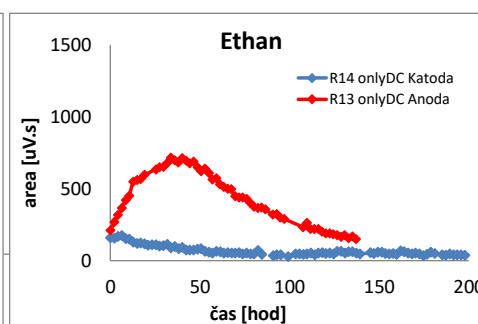
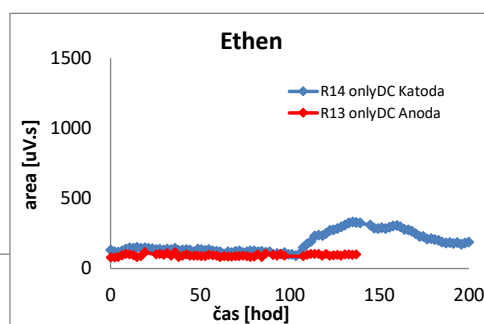
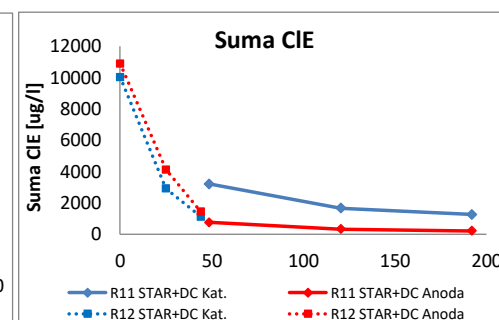
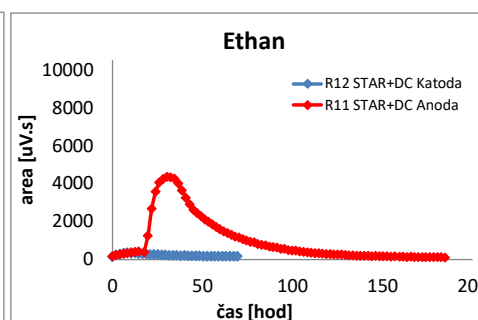
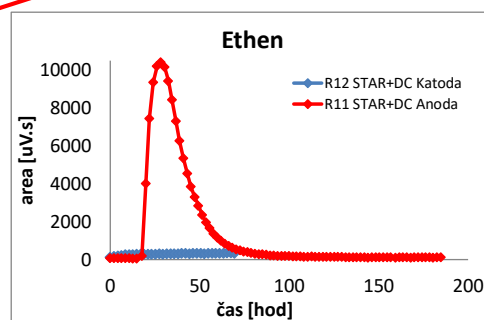
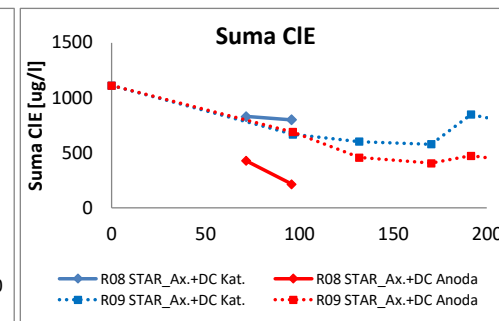
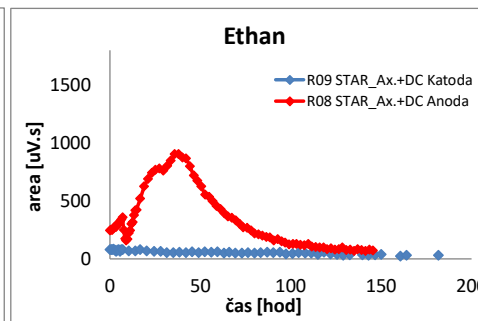
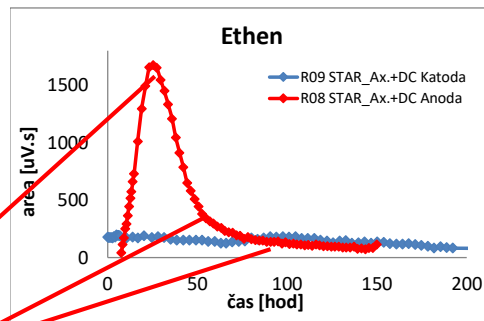
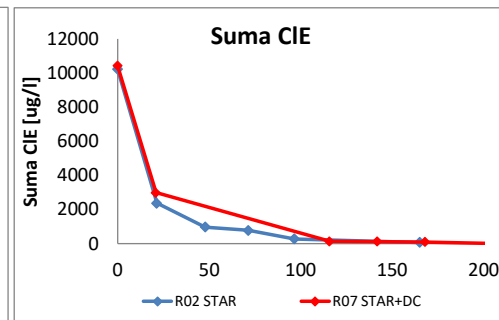
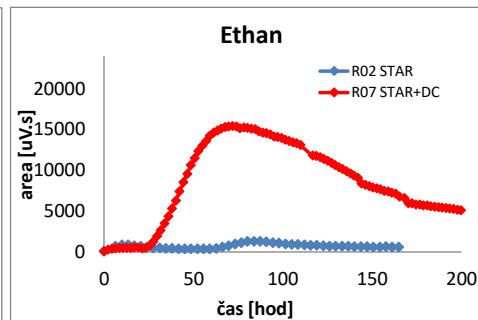
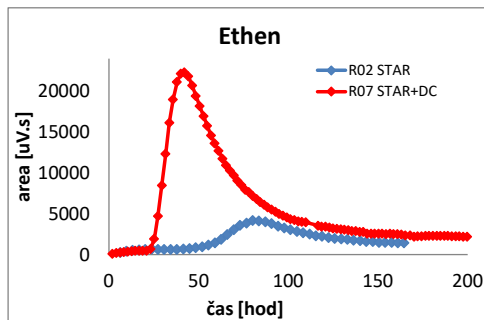
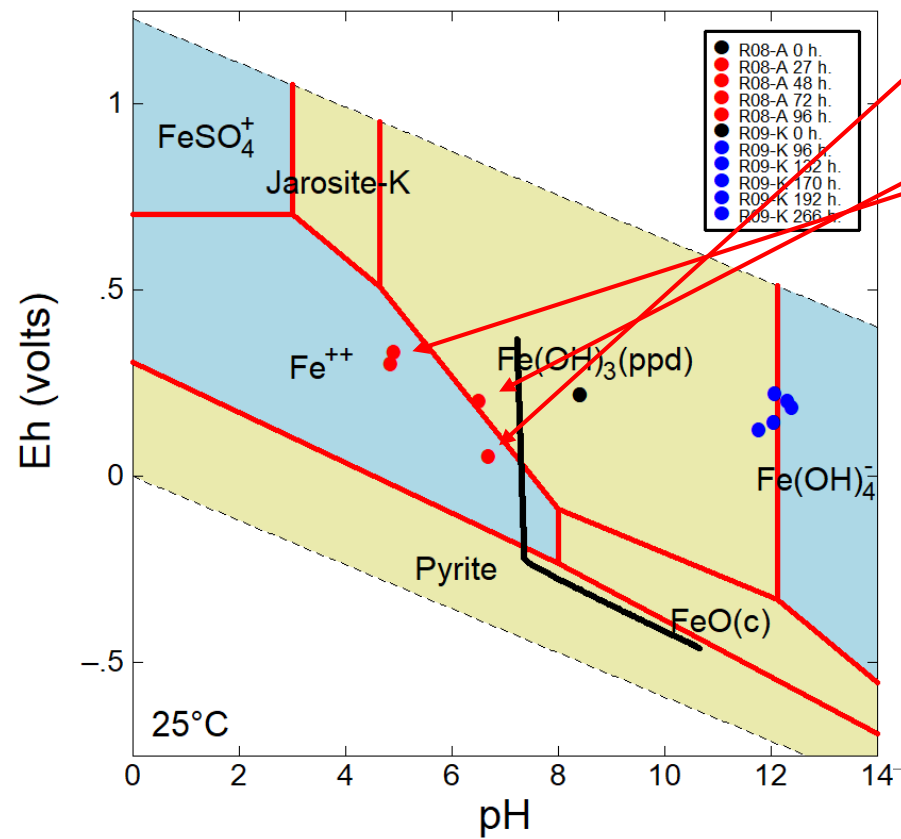
- R08, R09 – NANOFER STAR Ax. + DC
- R11, R12 – NANOFER STAR + DC
- R13, R14 - DC



# VÝSLEDKY TESTŮ

## Oddělené uspořádání reaktorů

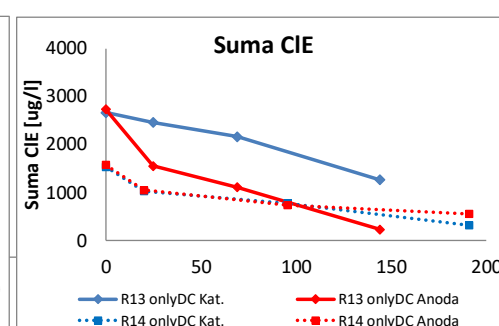
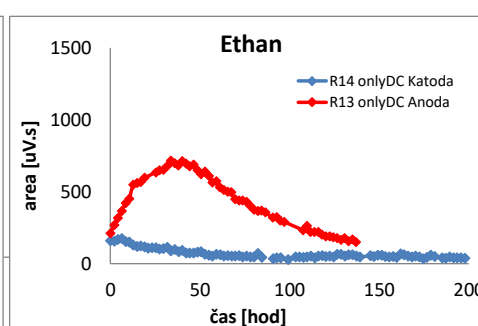
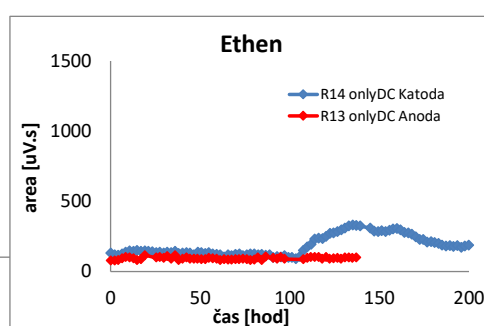
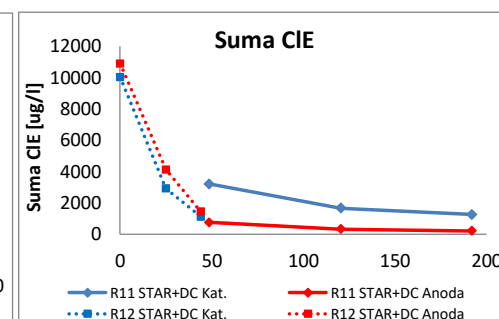
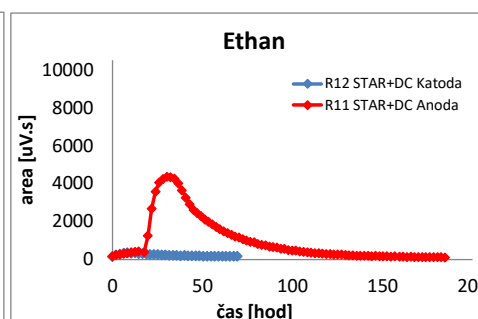
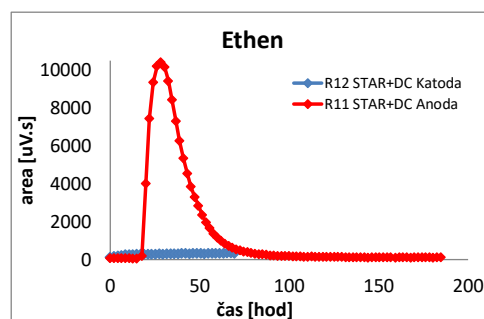
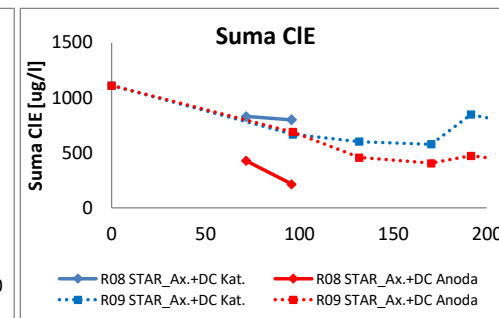
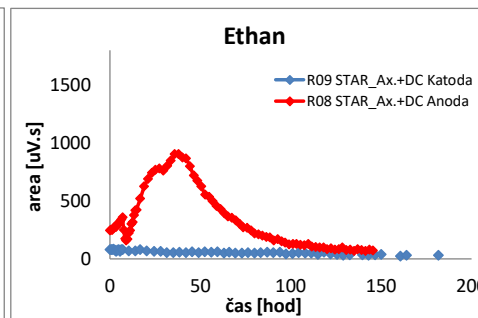
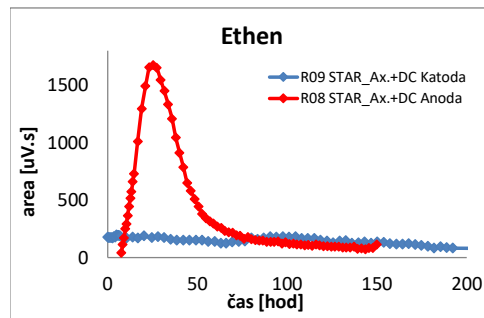
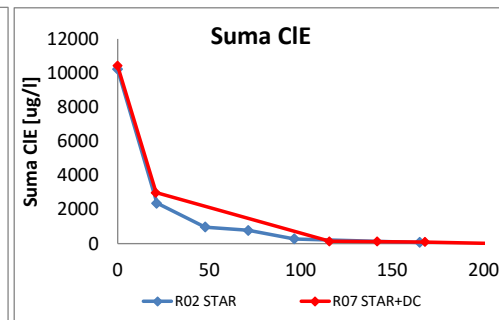
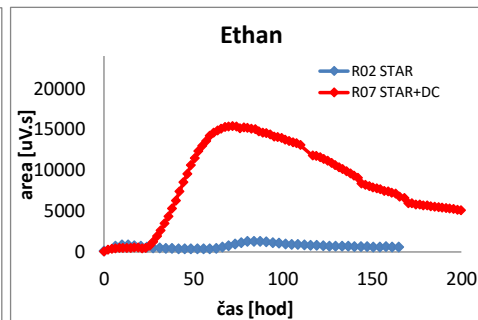
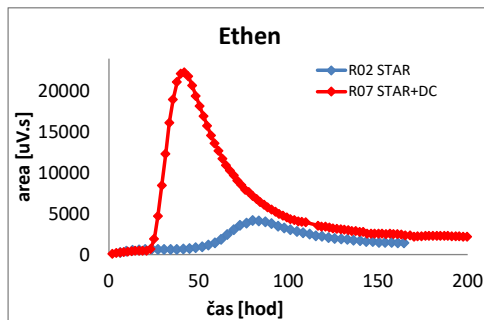
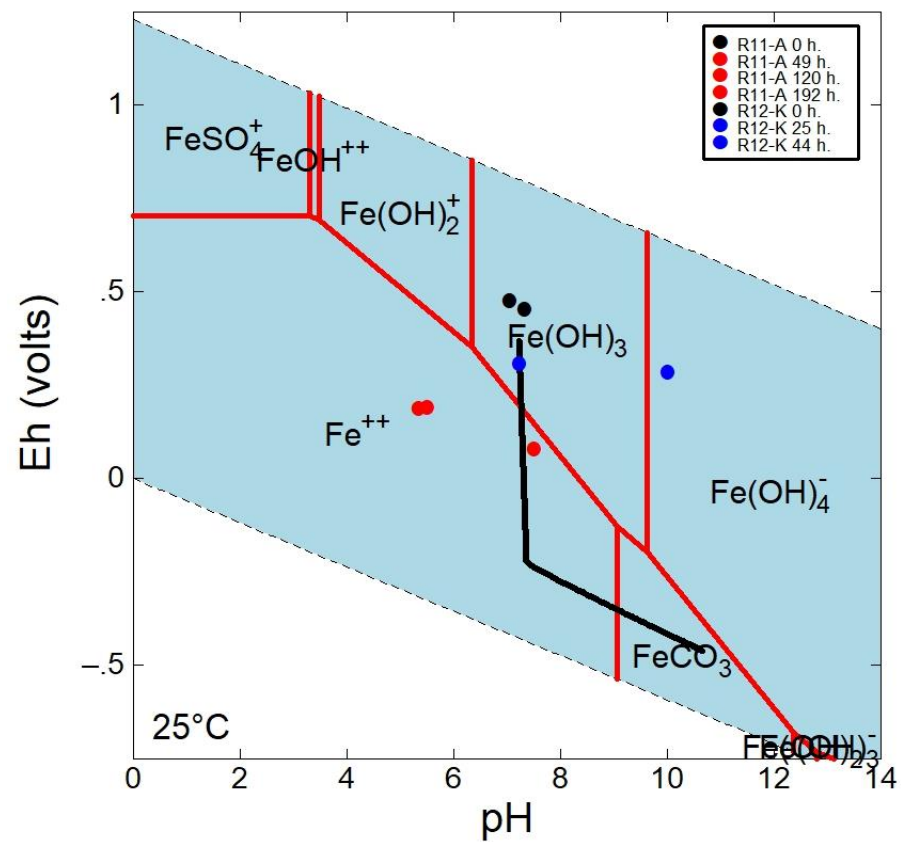
- R08, R09 – NANOFER STAR Ax. + DC
- R11, R12 – NANOFER STAR + DC
- R13, R14 - DC



# VÝSLEDKY TESTŮ

## Oddělené uspořádání reaktorů

- R08, R09 – NANOFER STAR Ax. + DC
- R11, R12 – NANOFER STAR + DC
- R13, R14 - DC

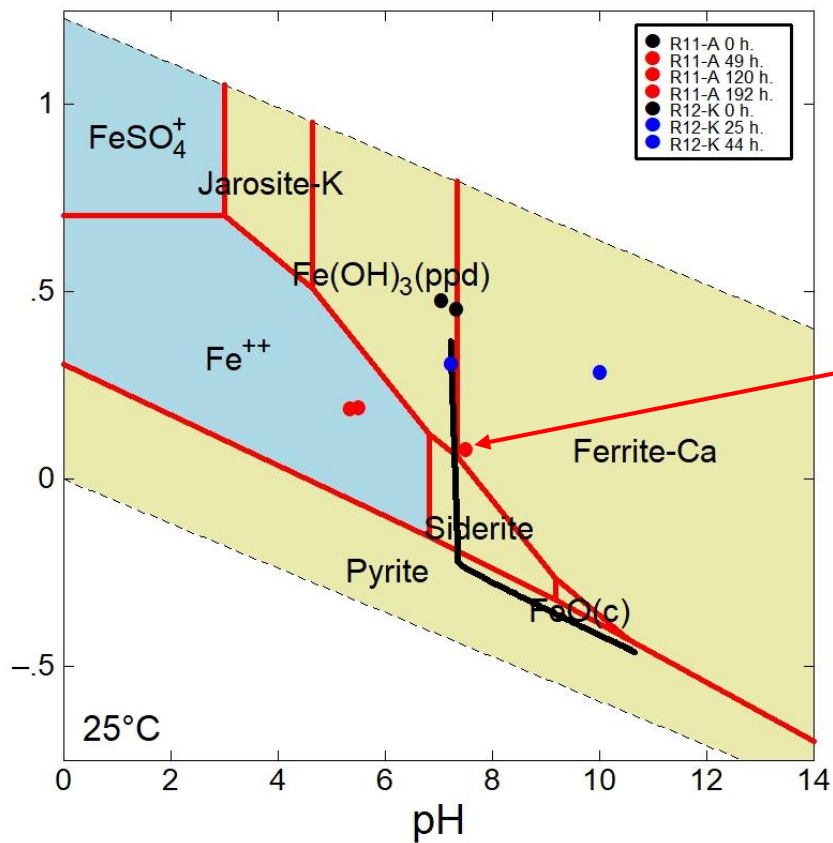
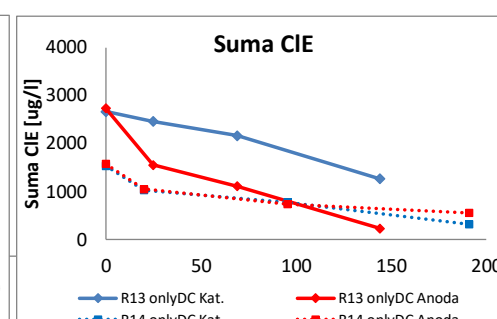
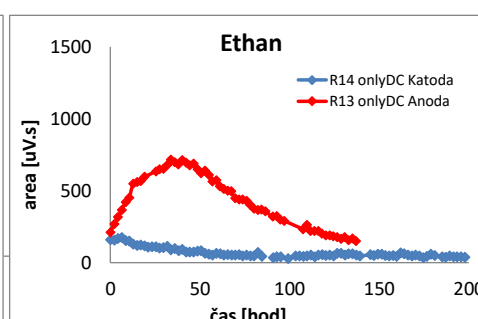
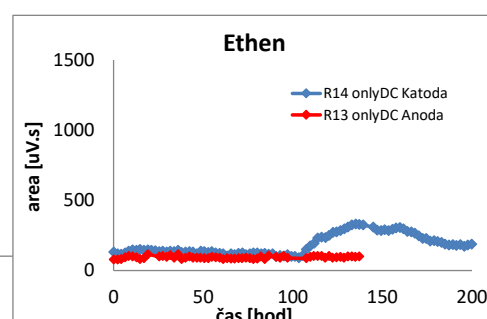
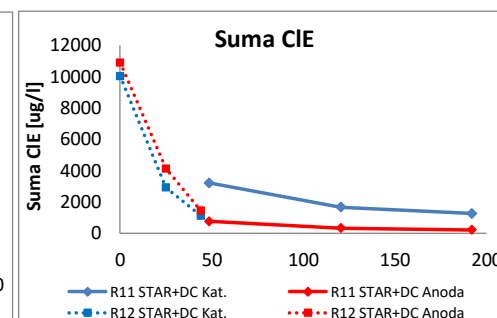
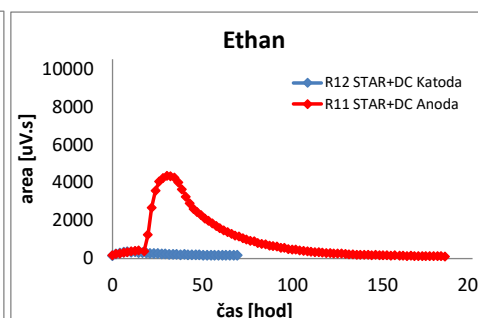
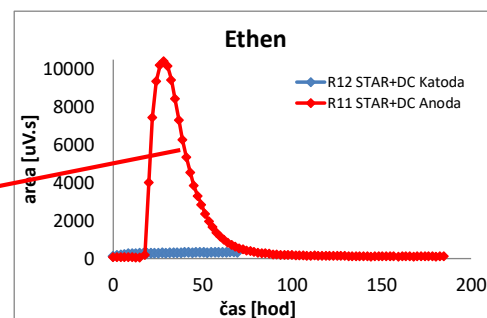
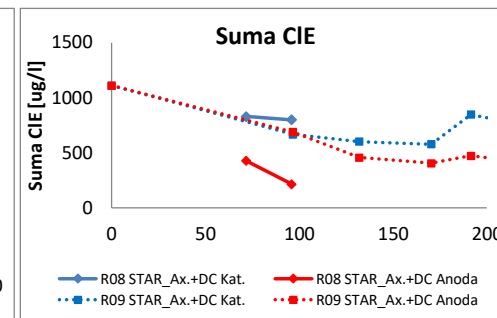
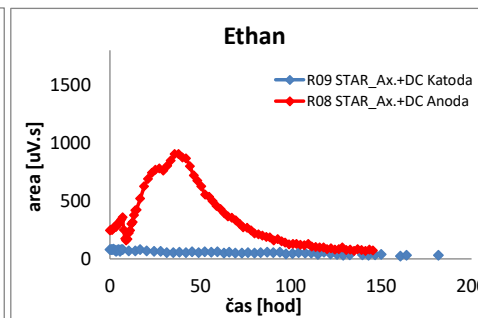
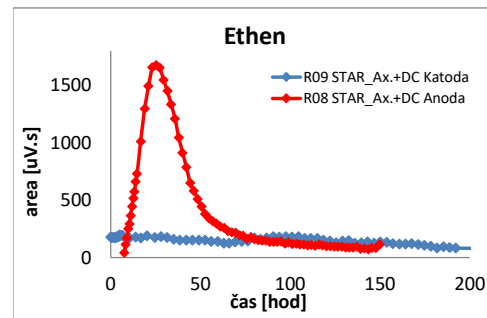
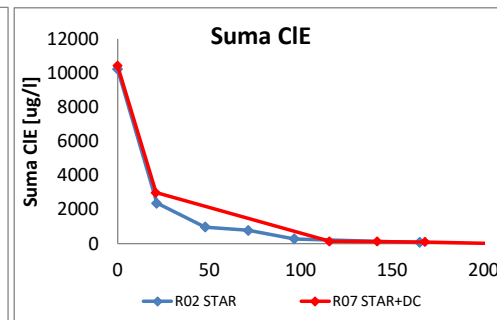
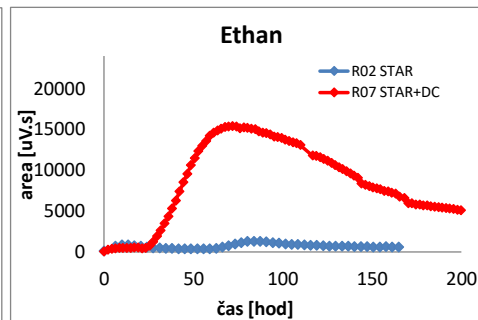
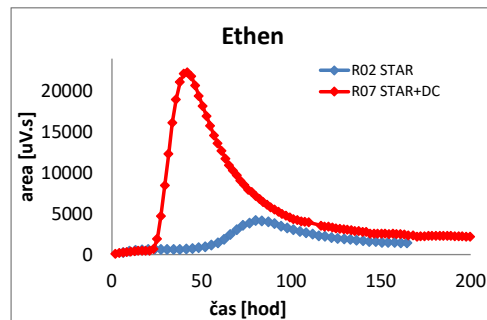




# VÝSLEDKY TESTŮ

## Oddělené uspořádání reaktorů

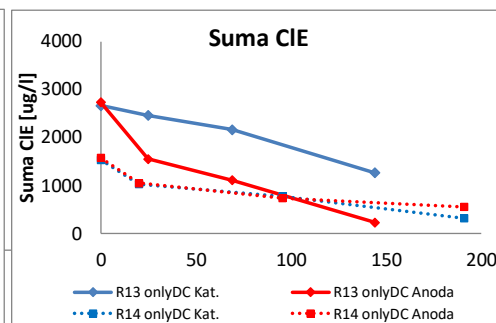
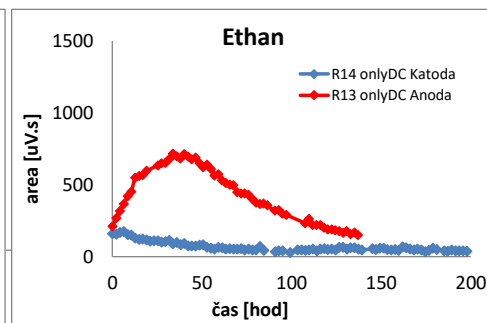
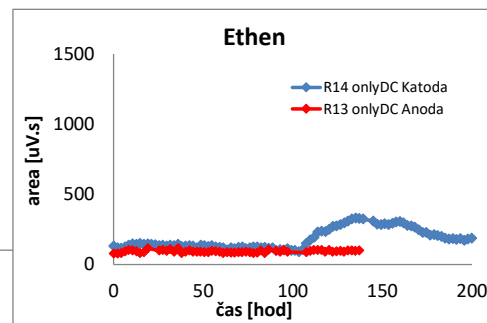
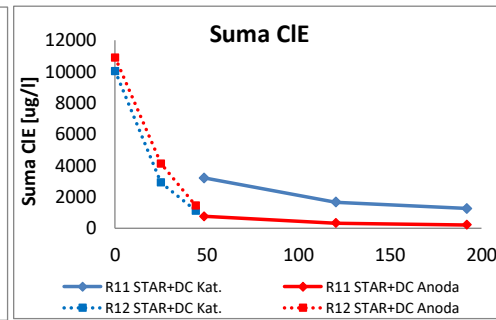
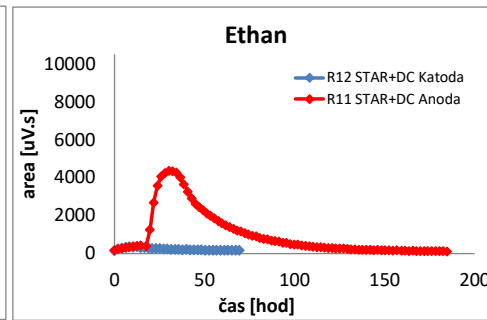
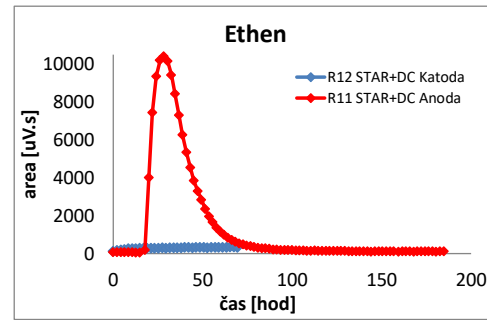
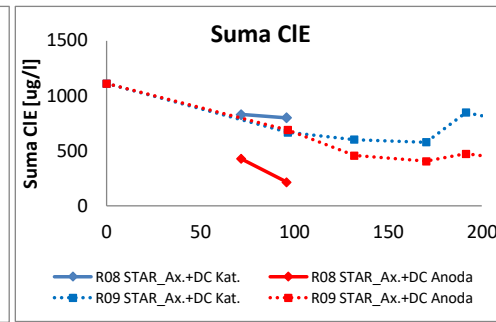
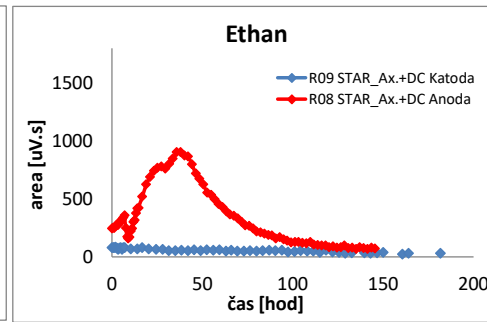
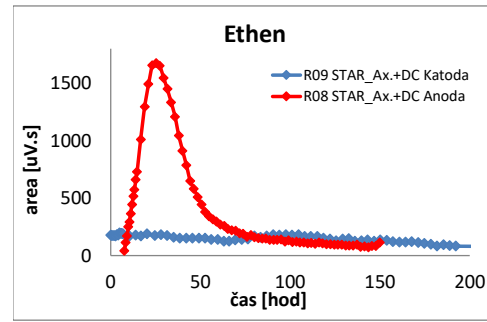
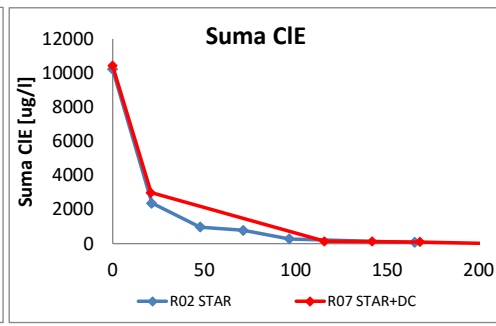
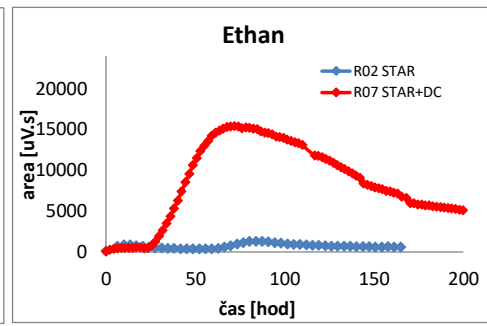
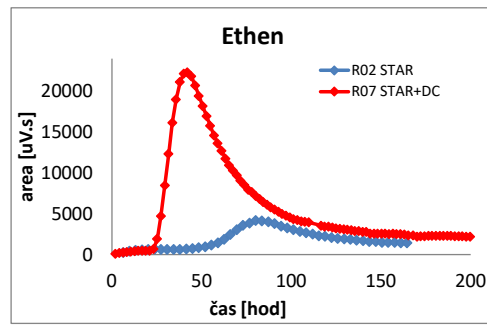
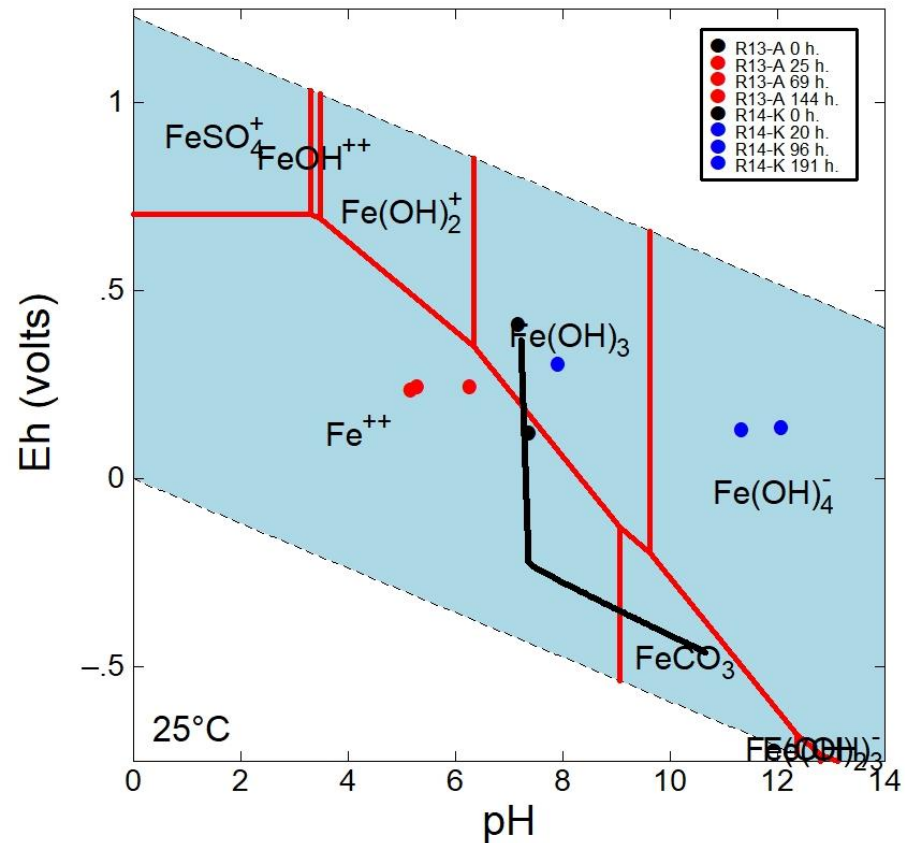
- R08, R09 – NANO FER STAR Ax. + DC
- R11, R12 – NANO FER STAR + DC
- R13, R14 - DC



# VÝSLEDKY TESTŮ

## Oddělené uspořádání reaktorů

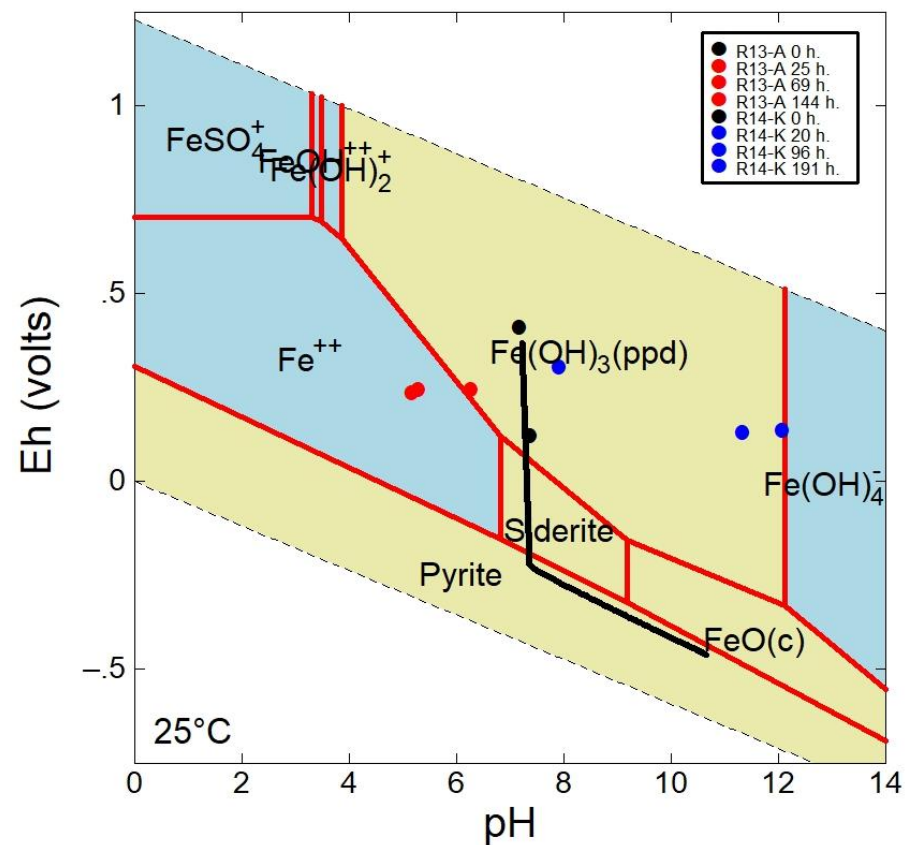
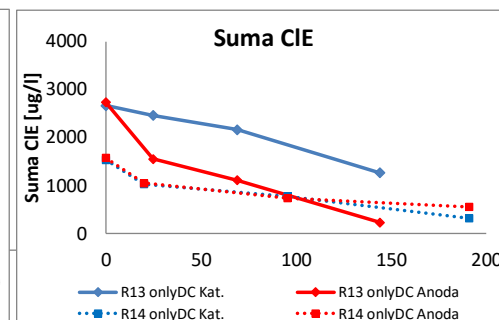
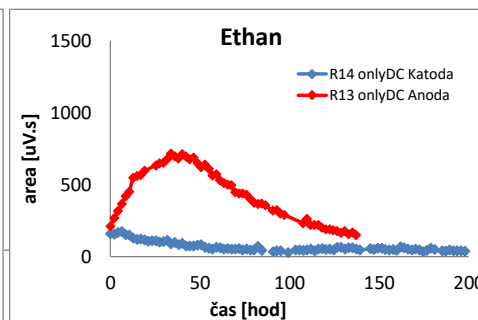
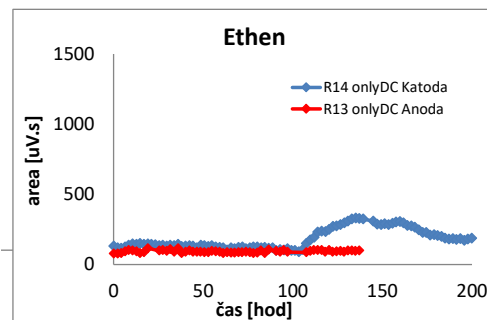
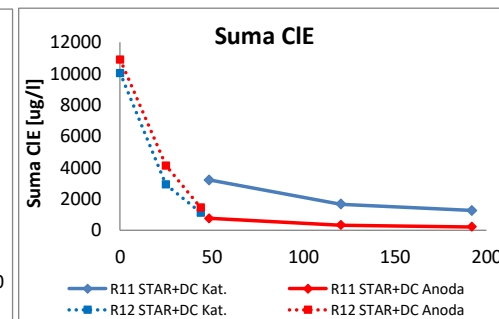
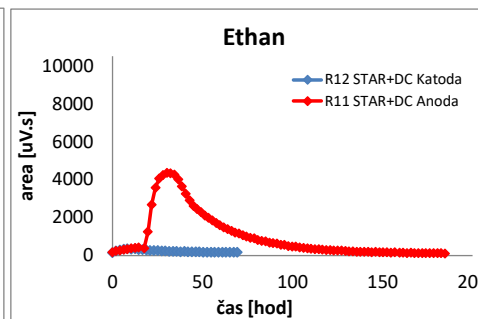
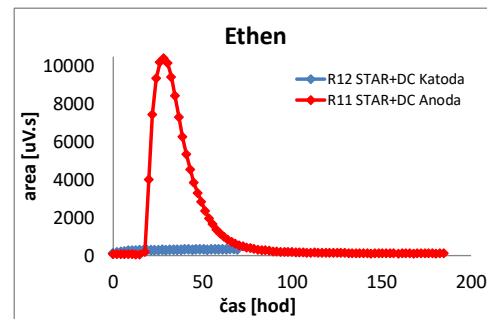
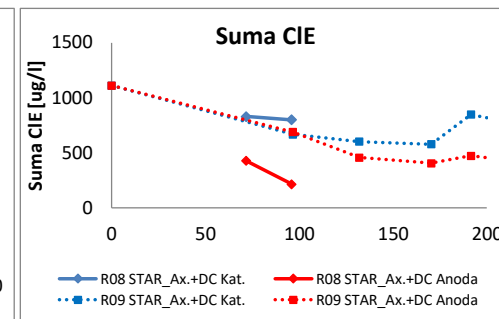
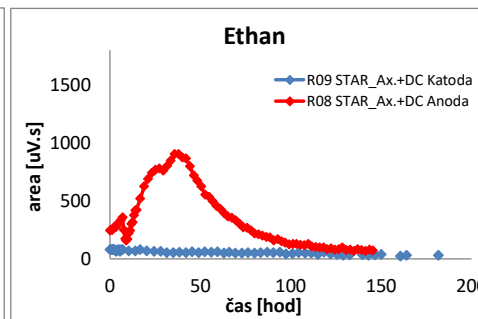
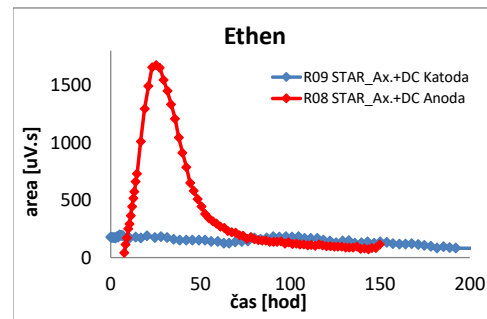
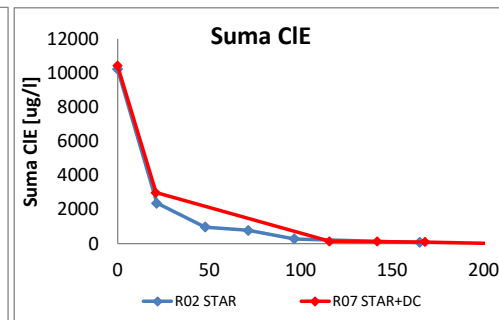
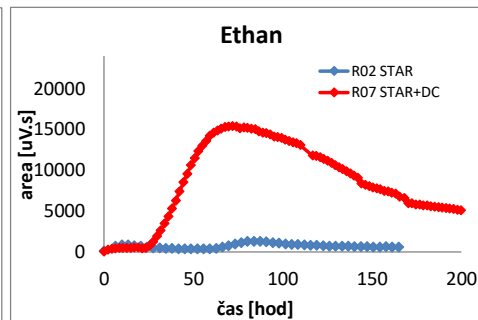
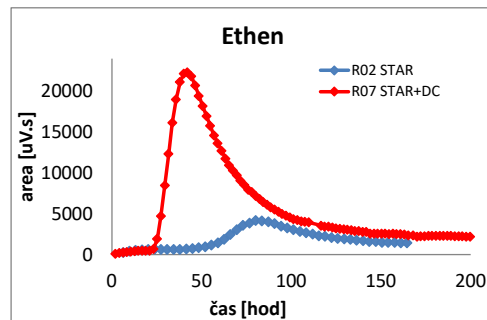
- R08, R09 – NANOFER STAR Ax. + DC
- R11, R12 – NANOFER STAR + DC
- R13, R14 - DC



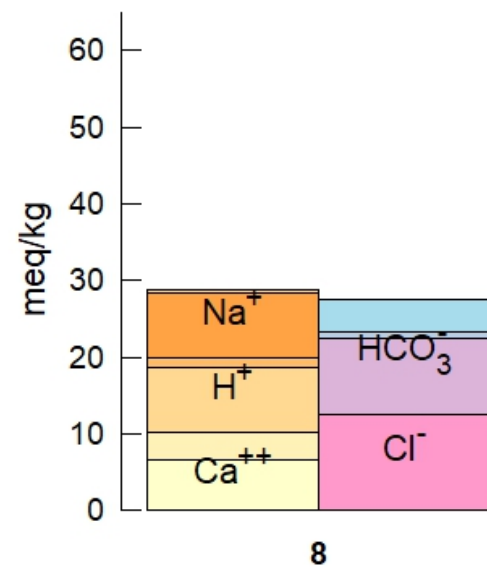
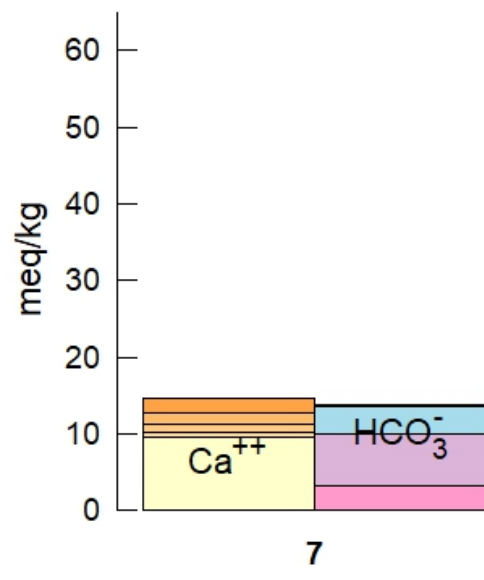
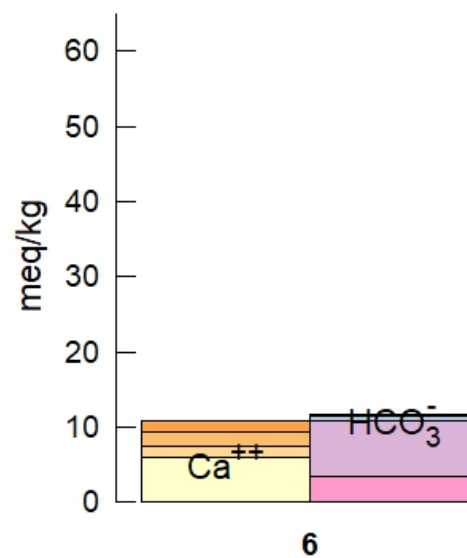
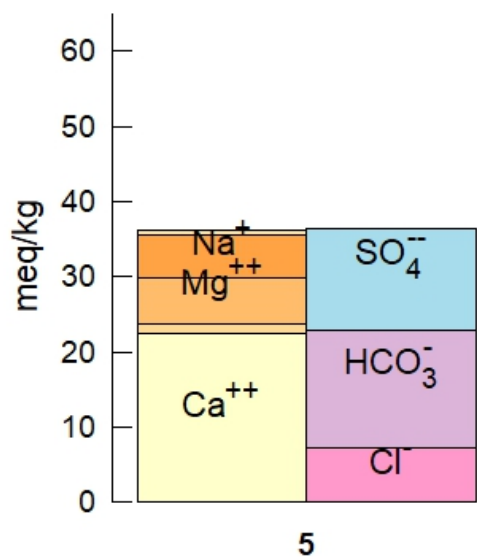
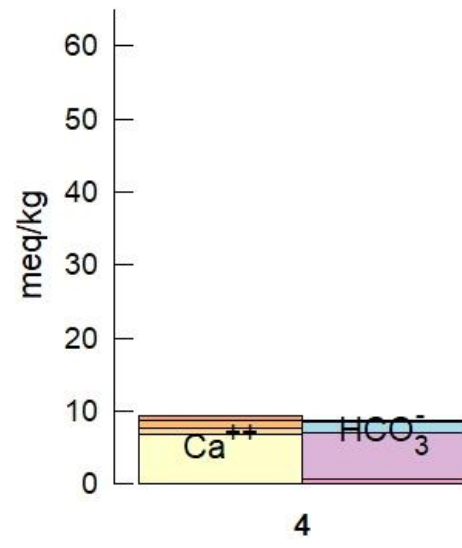
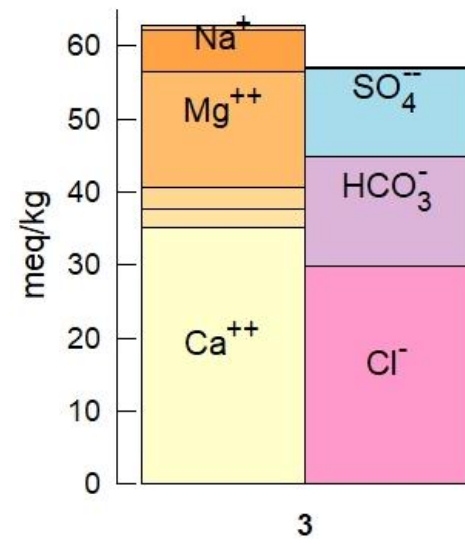
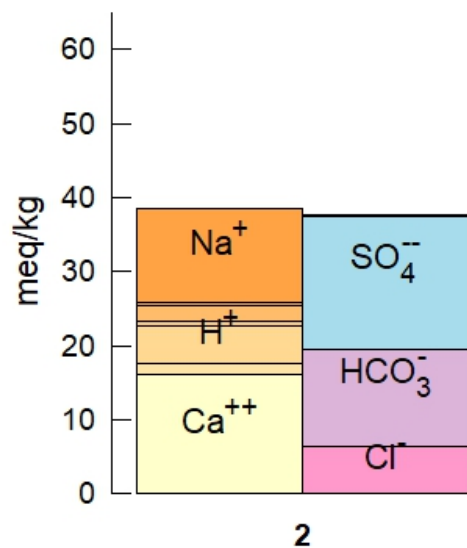
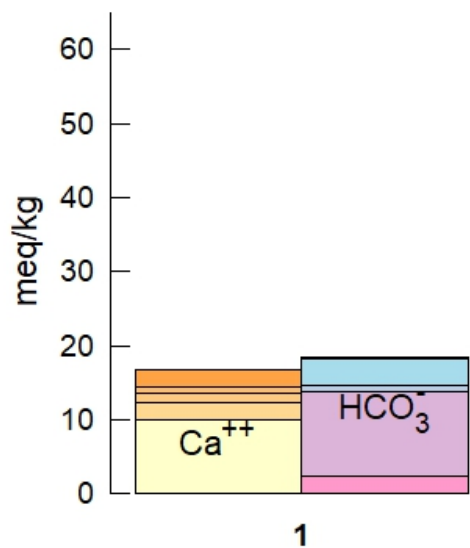
# VÝSLEDKY TESTŮ

## Oddělené uspořádání reaktorů

- R08, R09 – NANOFER STAR Ax. + DC
- R11, R12 – NANOFER STAR + DC
- R13, R14 - DC

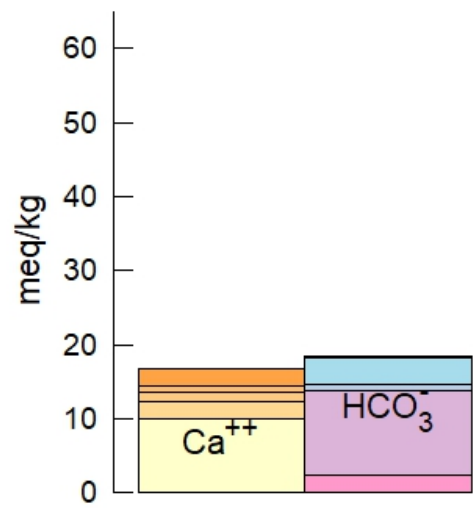


# POROVNÁNÍ RŮZNÝCH TYPŮ VOD

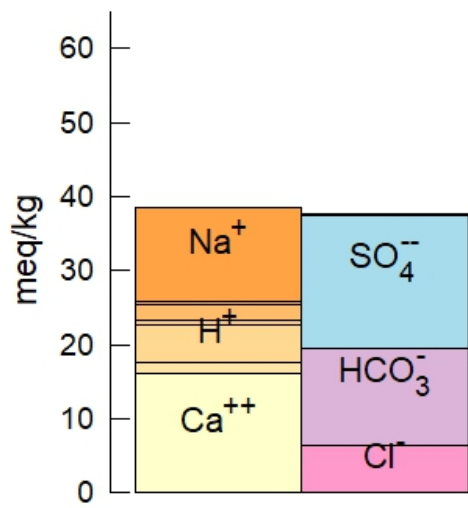




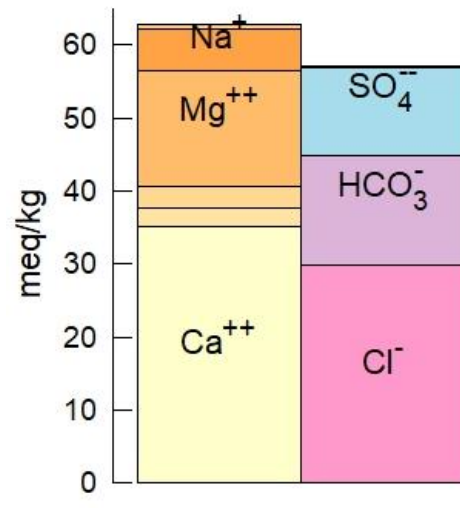
# POROVNÁNÍ RŮZNÝCH TYPŮ VOD



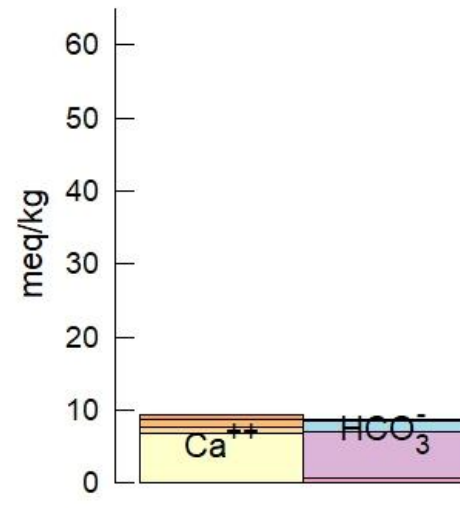
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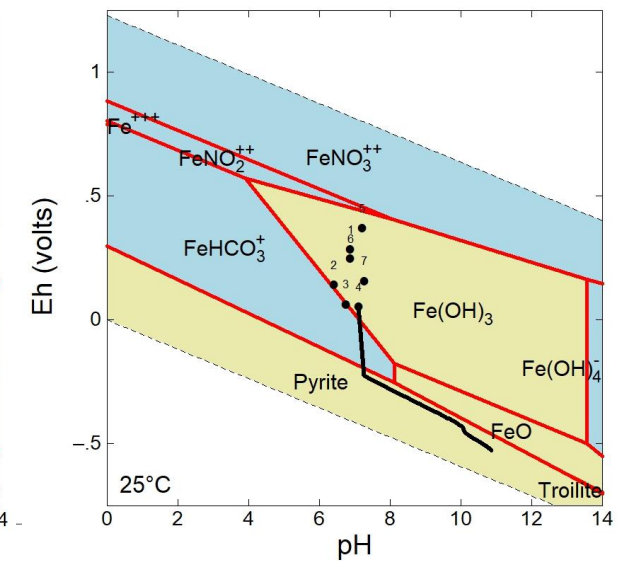
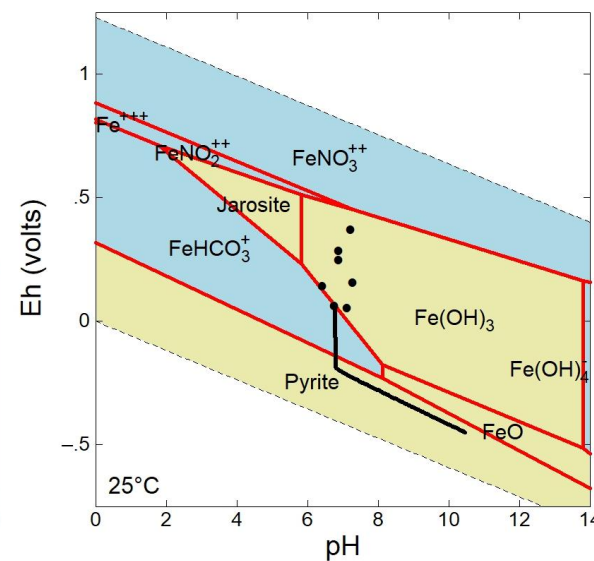
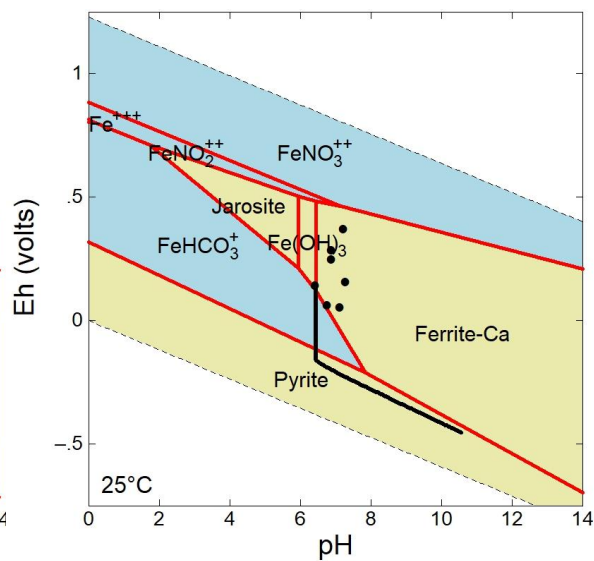
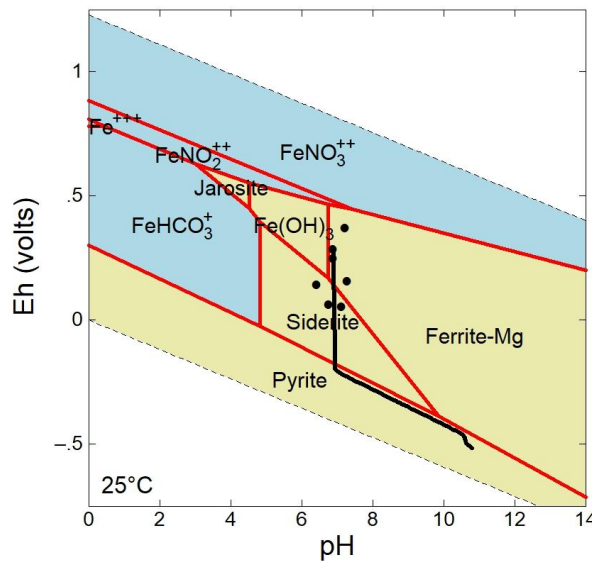
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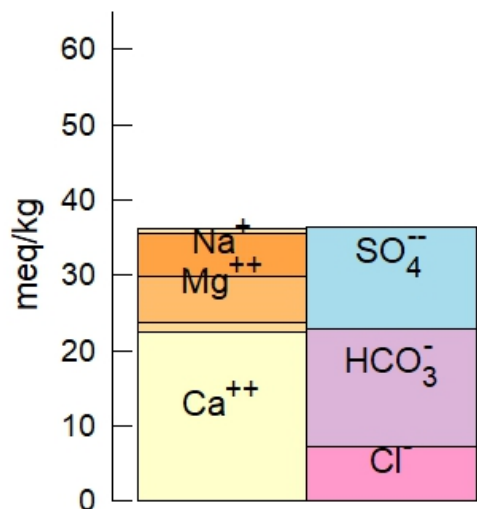
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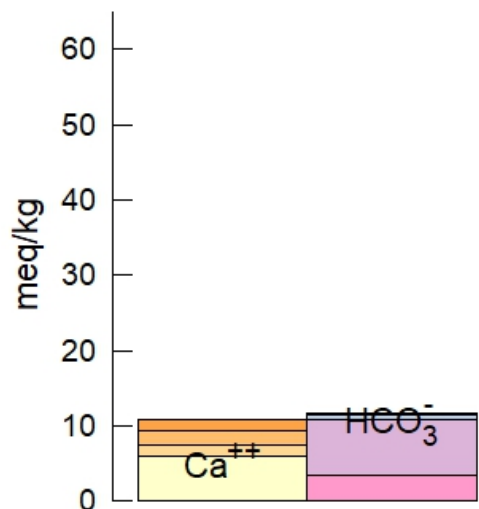
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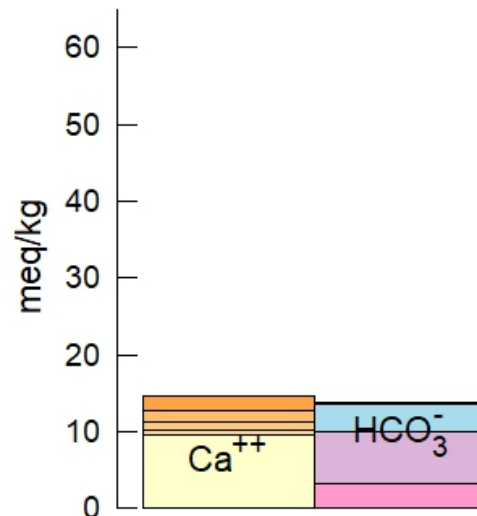
# POROVNÁNÍ RŮZNÝCH TYPŮ VOD



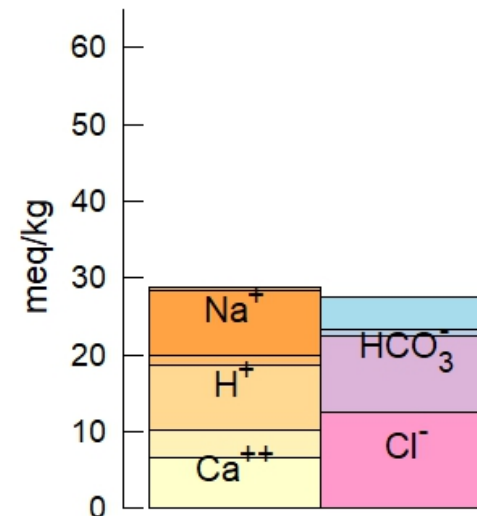
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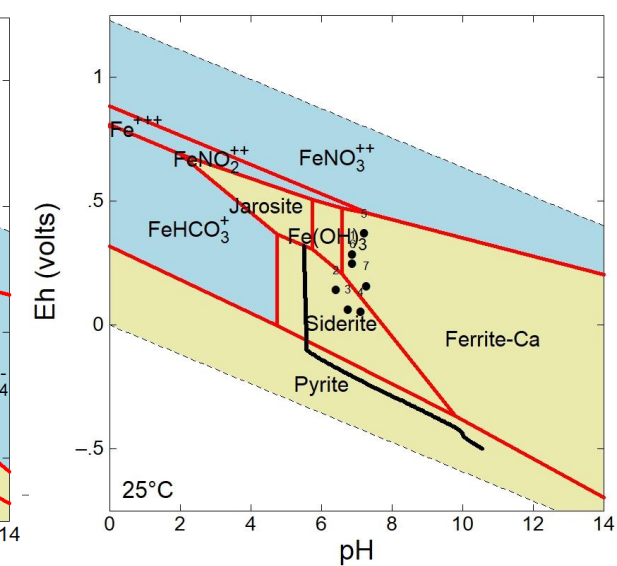
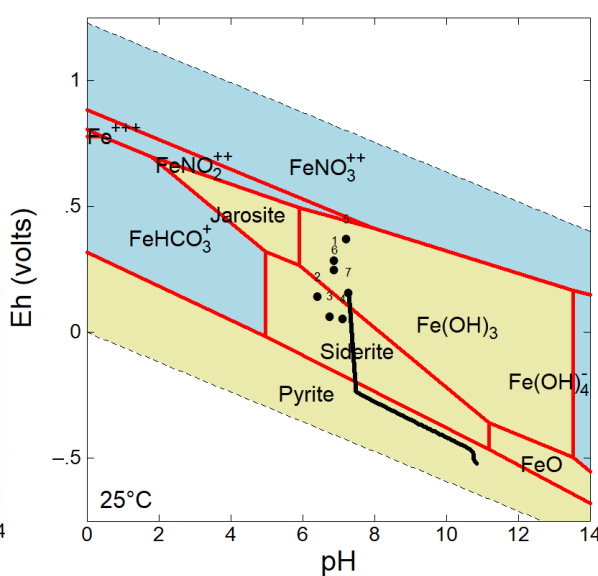
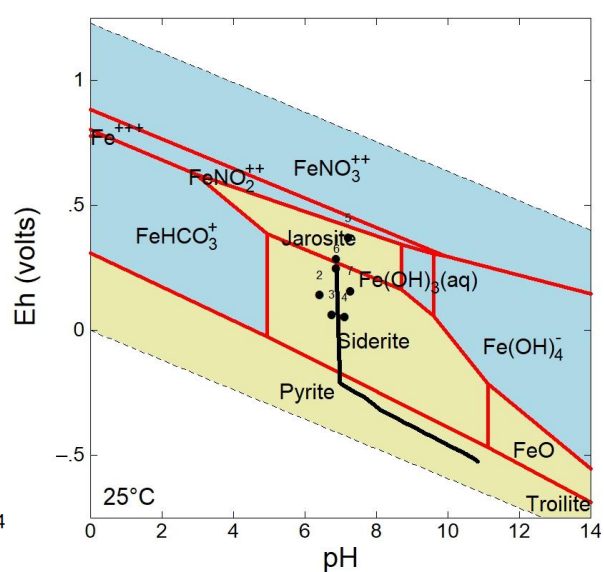
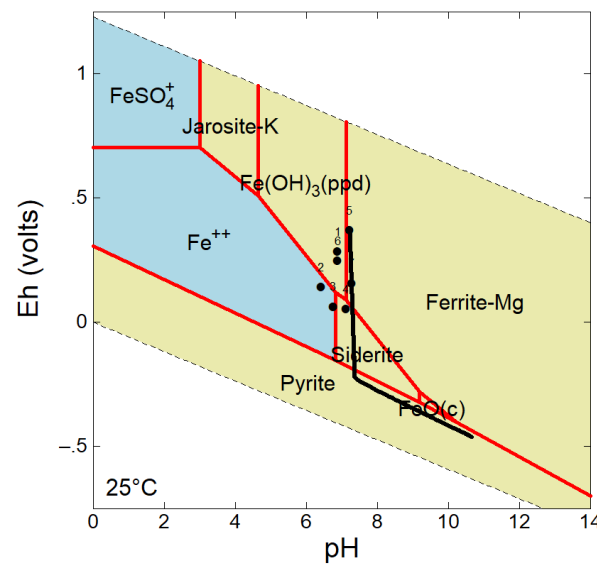
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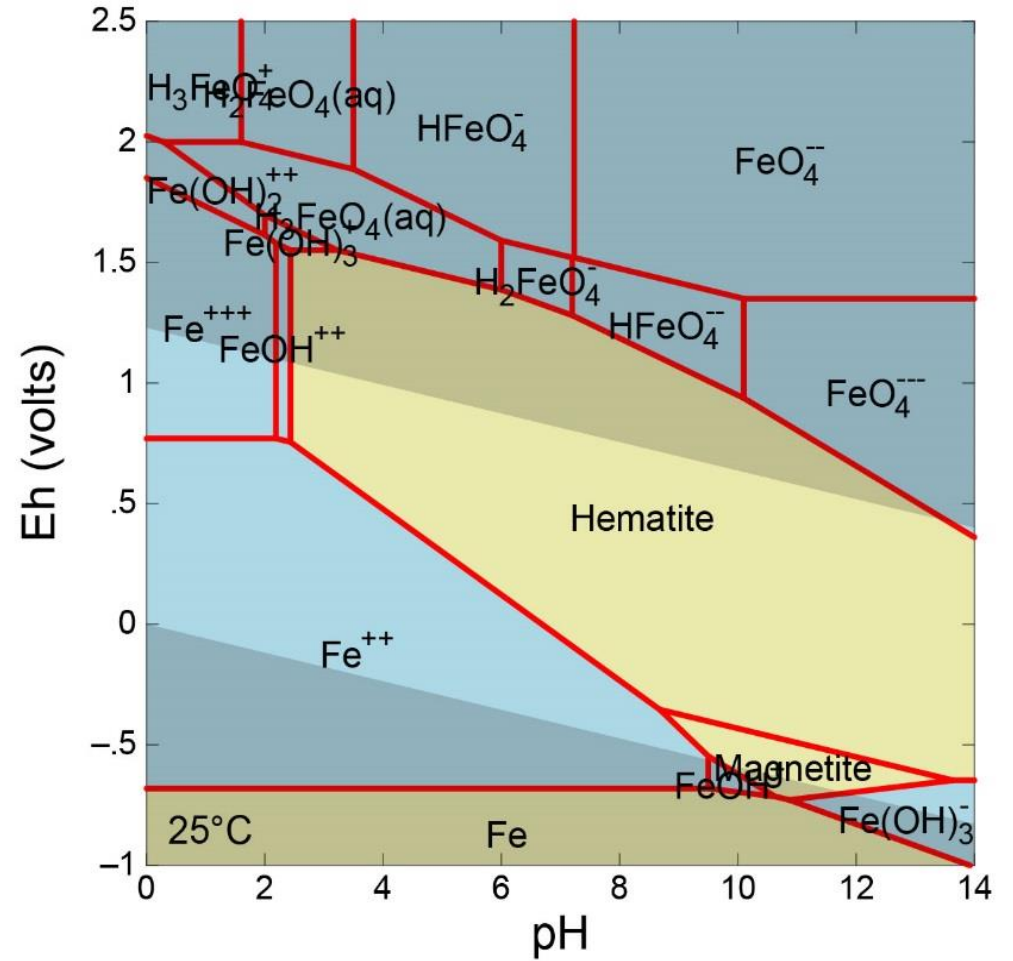
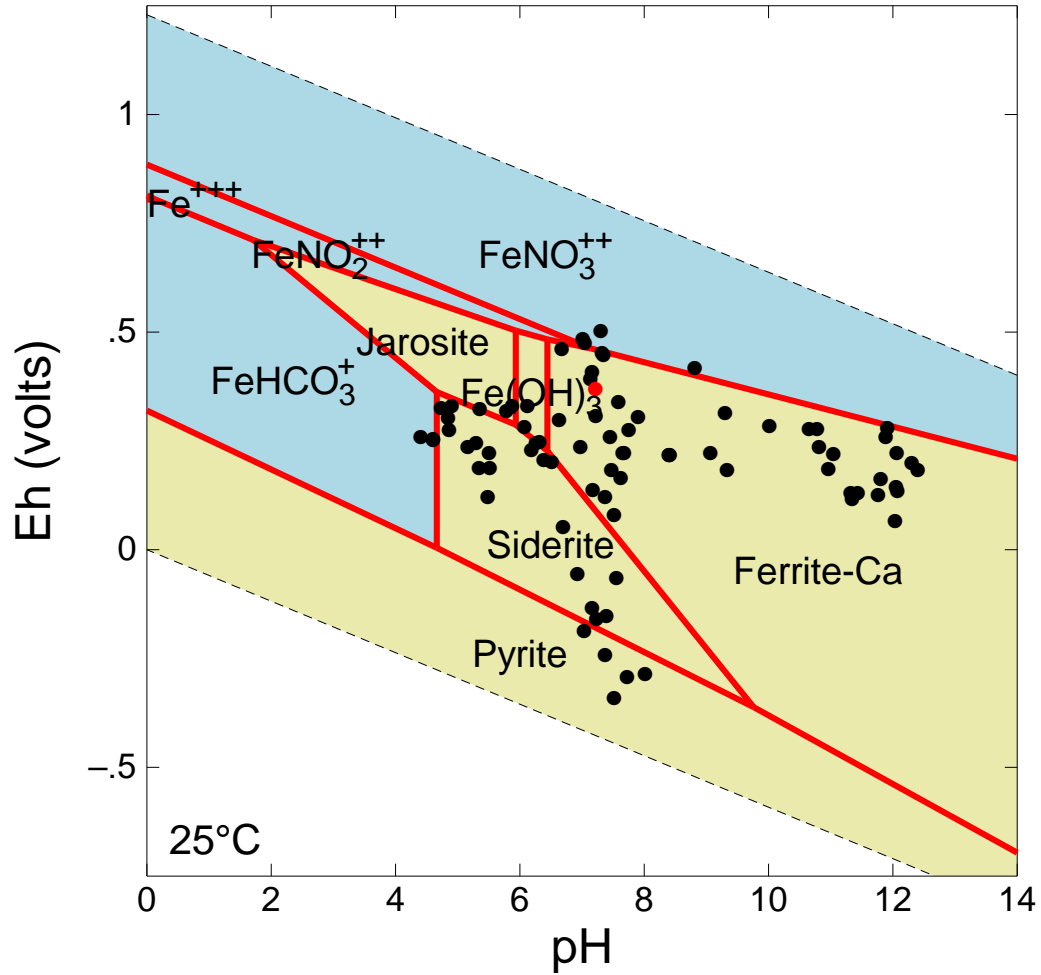
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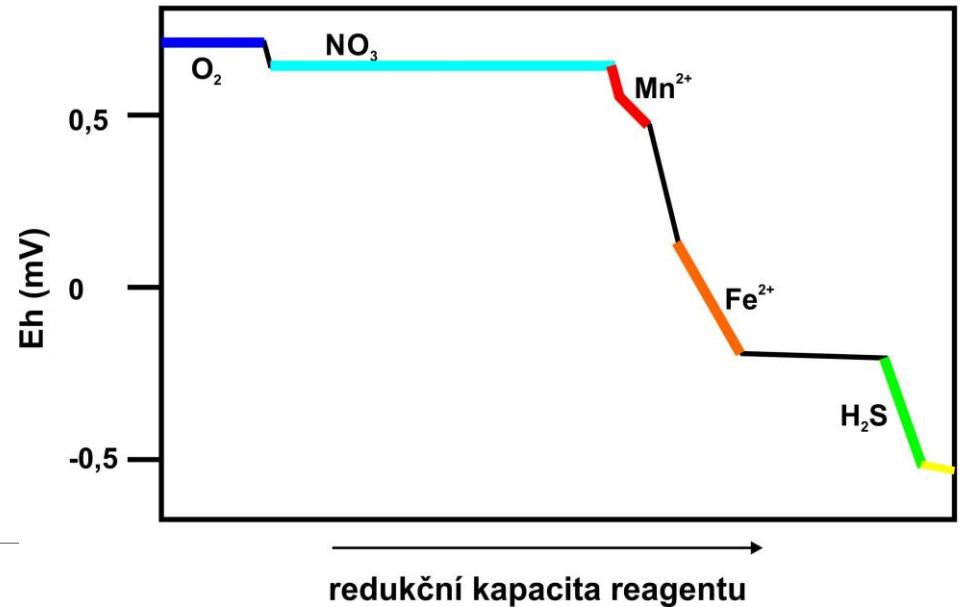
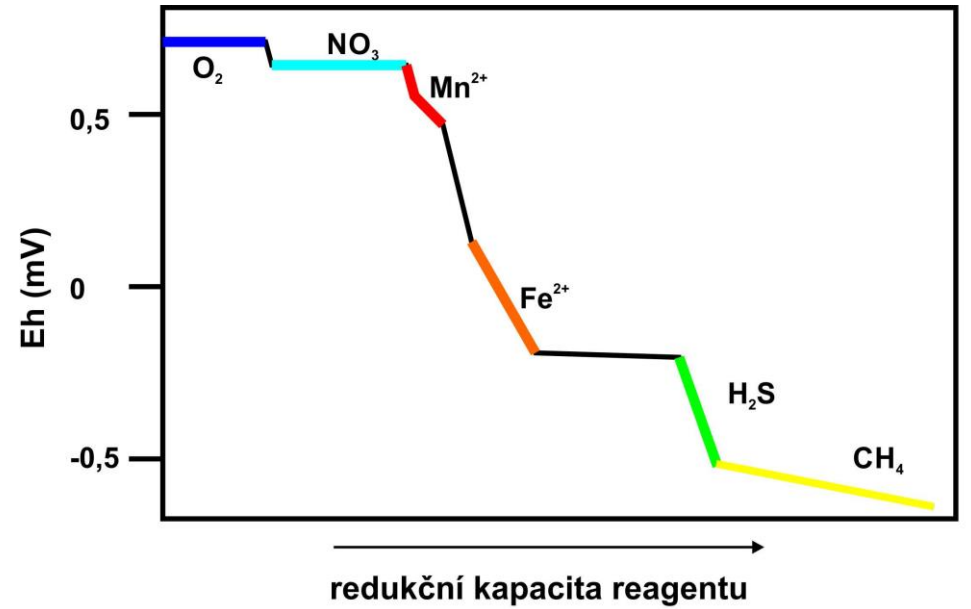
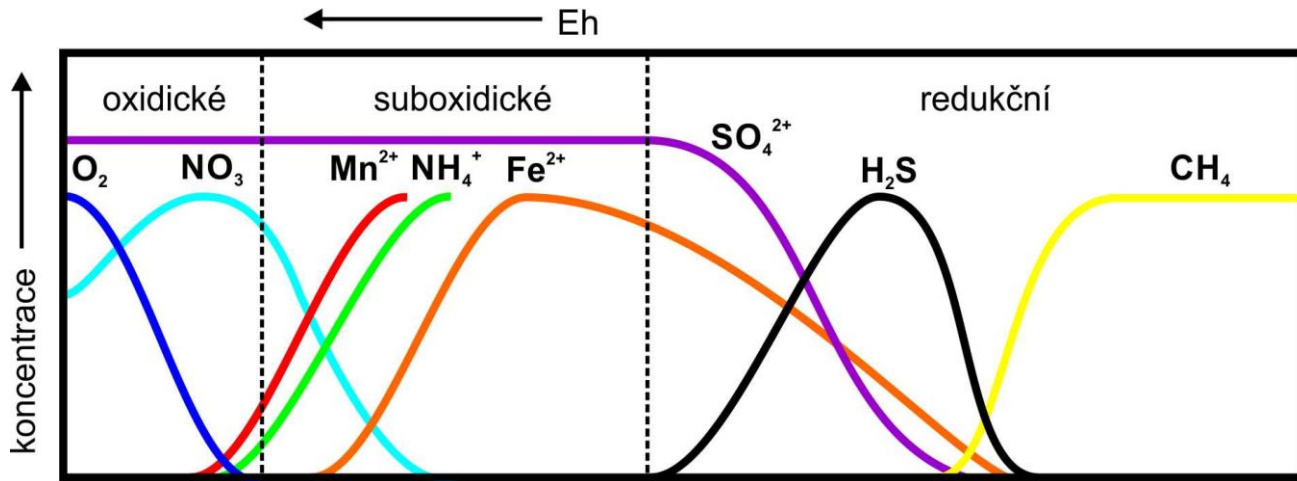
8



# ZÁVĚR



# ZÁVĚR





# POUŽITÁ LITERATURA

- BETHKE, C., M., 2008: Geochemical and Biogeochemical Reaction Modeling, Cambridge University Press, Cambridge.
- HRABAL J., NOSEK J., BENEŠ P., 2016: Pokročilé in-situ sanační technologie podporované elektrickým polem. Průběžná roční zpráva projektu TAČR TA04020431. MEGA a.s., Stráž pod Ralskem.
- ZEMAN, J., 2014: Stability of iron species in water. MS, Brno.

# PODĚKOVÁNÍ

- Tato práce byla realizována za podpory Technologické agentury ČR v rámci výzkumného projektu TH03030374 „Pokročilé real-time řízení sanačních technologií“.

**DĚKUJI ZA POZORNOST.**

**Vendula Cencerová**