

# REGIONAL CENTRE OF ADVANCED TECHNOLOGIES AND MATERIALS

Regionální centrum pokročilých technologií a materiálů



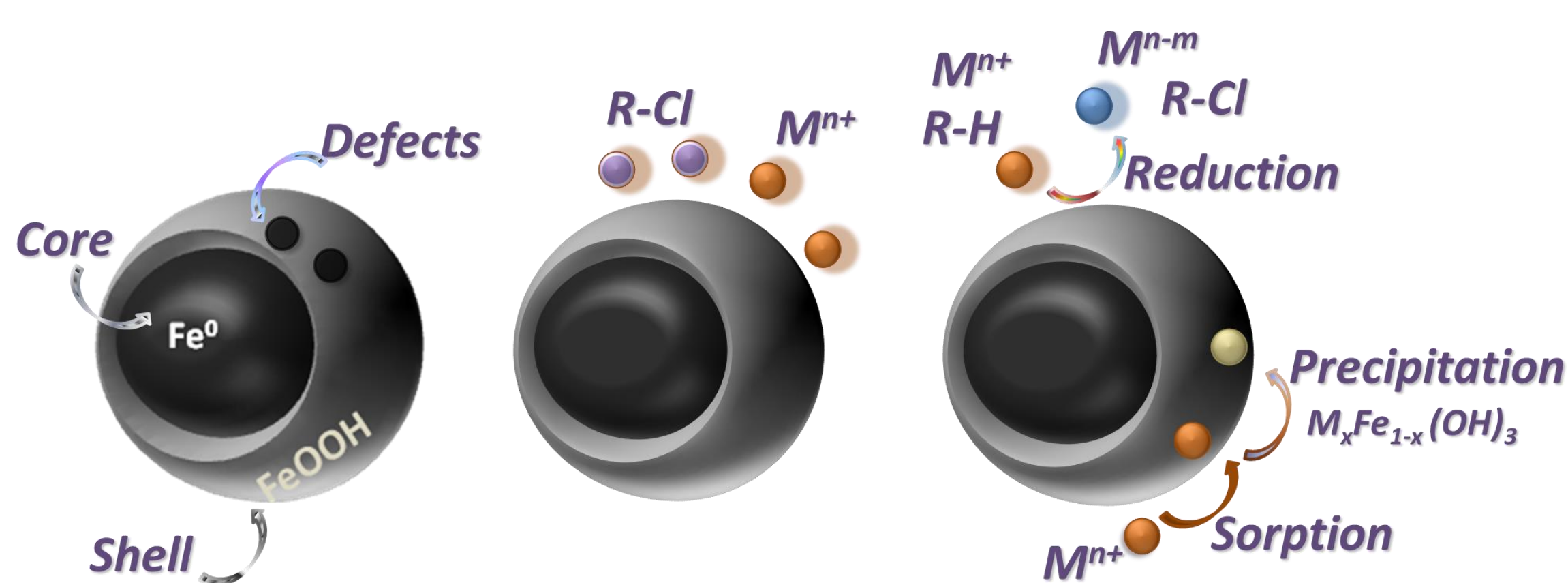
## Current Trends in the Field of Nanomaterials Designed for Advanced Water-Treatment Technologies

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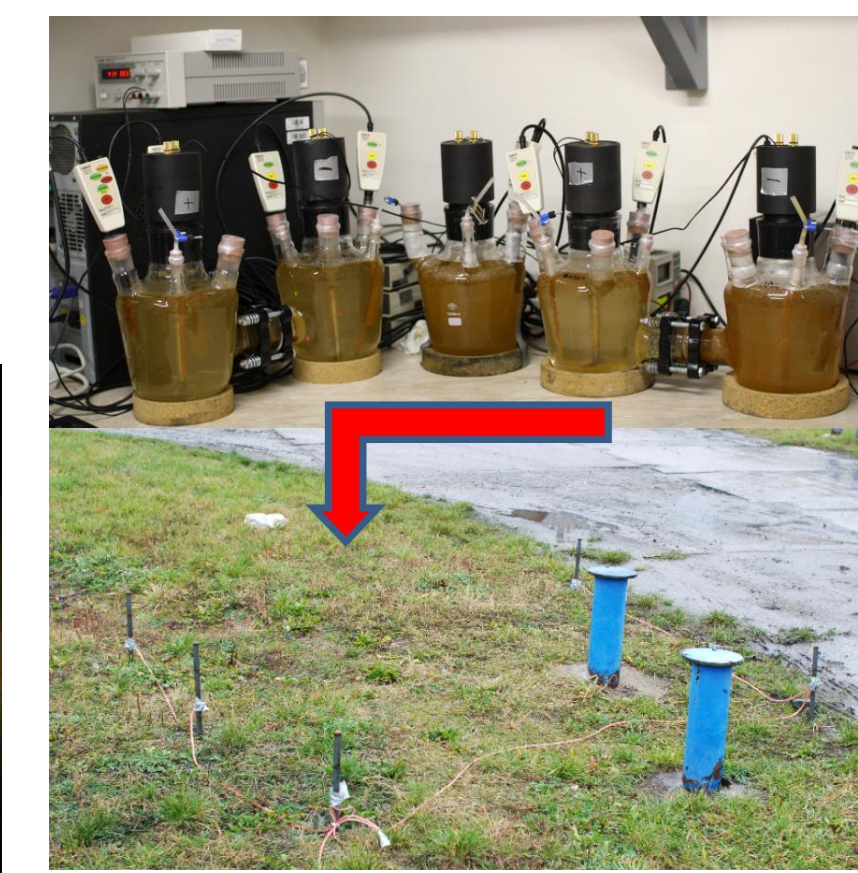
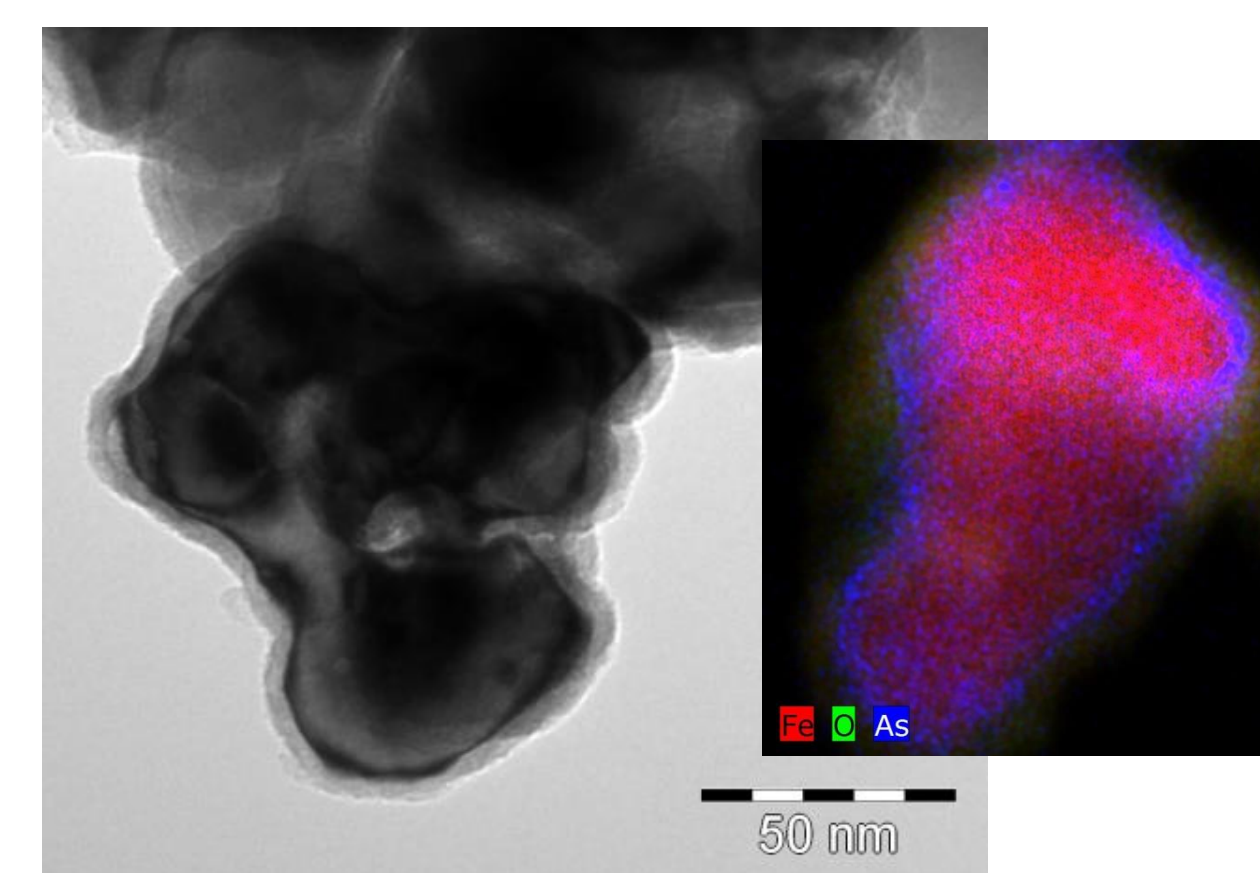
### Nanoscale Zero Valent Iron (nZVI)



Nano Zero Valent Iron (nZVI) can reduce and remove effectively various contaminants through different mechanisms (absorption, reduction, co-precipitation)

Modified nZVI have highly enhanced remediation ability (less observed agglomeration, air-oxidation protection, higher surface area, homogeneous dispersion and narrower size distribution).

NANOIRON® FUTURE TECHNOLOGY

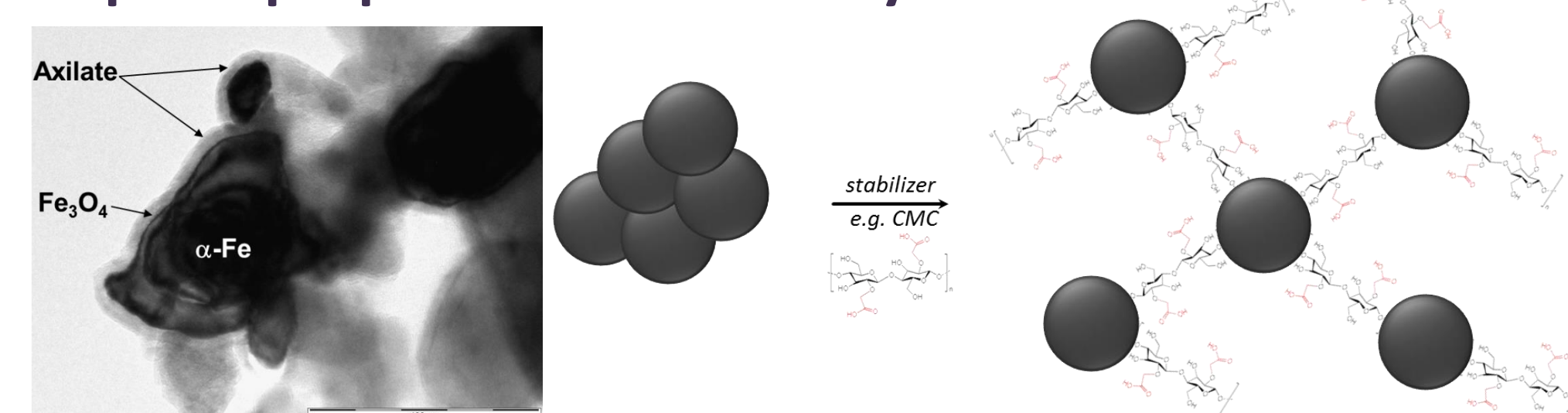


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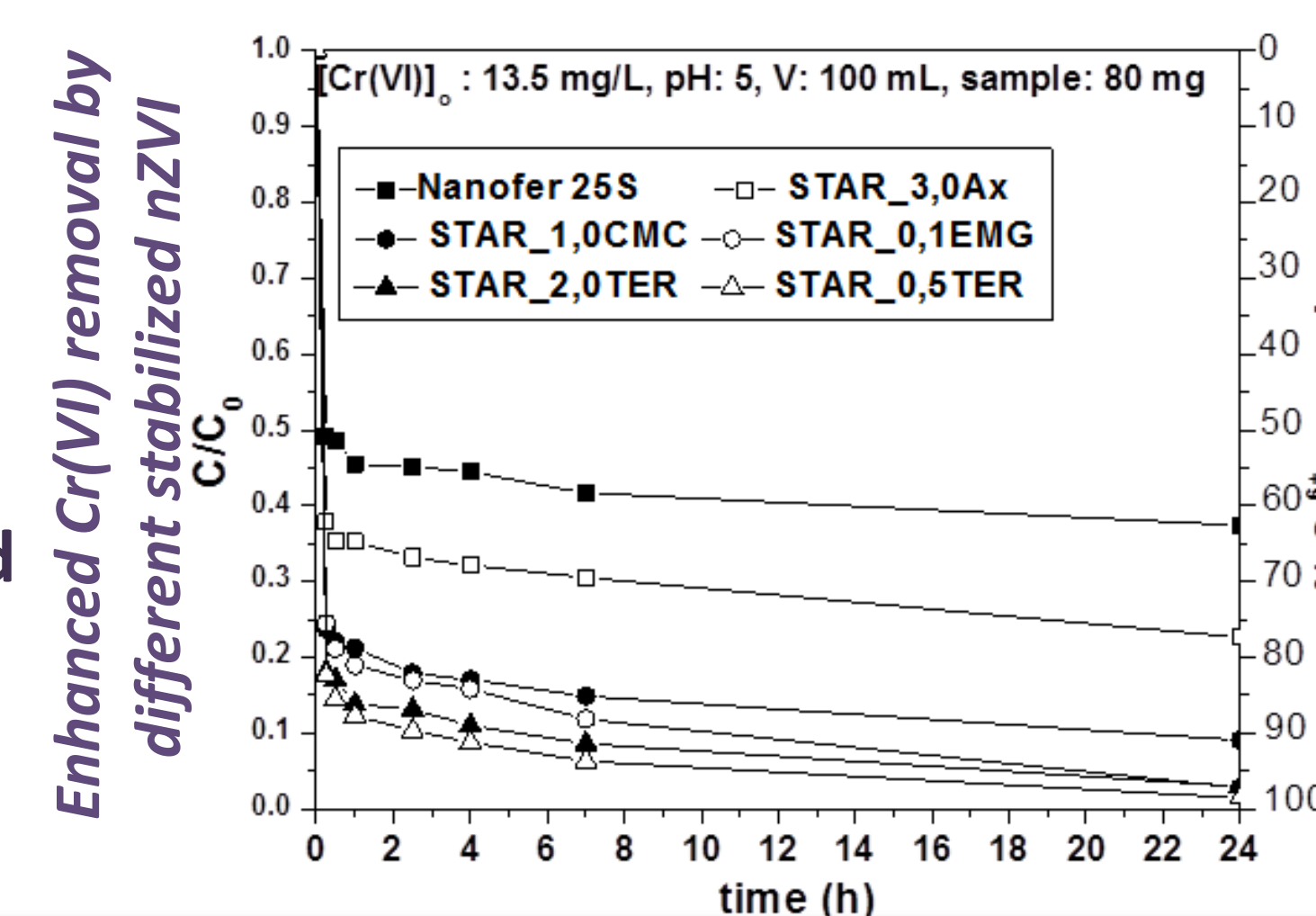
### Surface Modified nZVI

Surface modification by stabilizers provides physically more stable and chemically more reactive nZVI. Prevents particles from agglomerating, increase sorption properties and mobility.

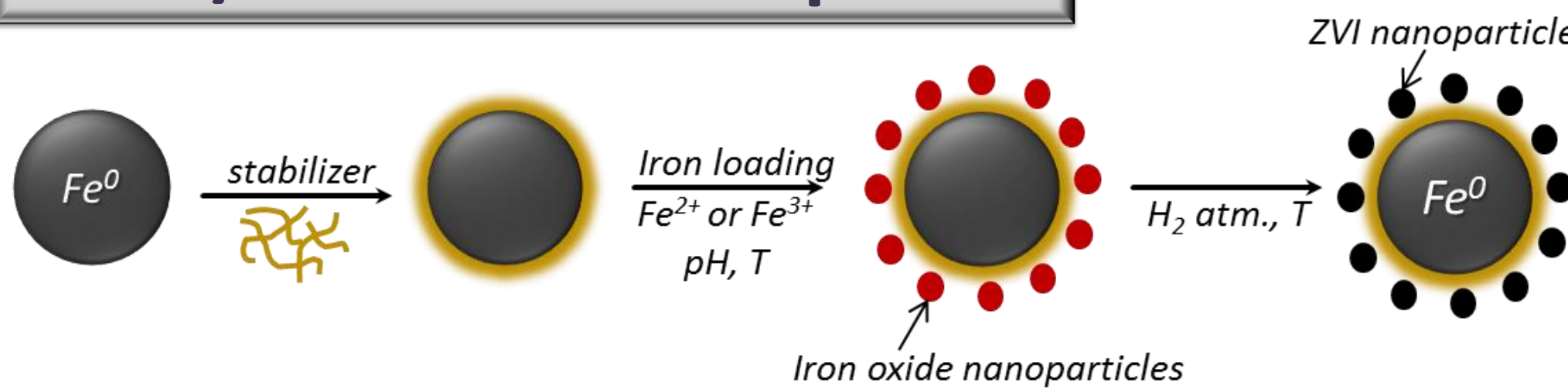


#### Stabilizers:

- poly(acrylic) acid
- poly(ethylenglycol)
- carboxymethylcellulose
- potato starch
- alginate
- chitosan
- polyoxyethylenesorbitane monooleate
- Axilate 32S dispersion of sodium salt of polyacrylic acid
- poly(methyl) methacrylate
- polyaspartate
- poly(styrene) sulfonate
- triblock copolymer (PMAA48-PMMA17-PSS660)
- polyvinyl alcohol-co-vinylacetate-co-itaconic acid
- xanthan and guar gums

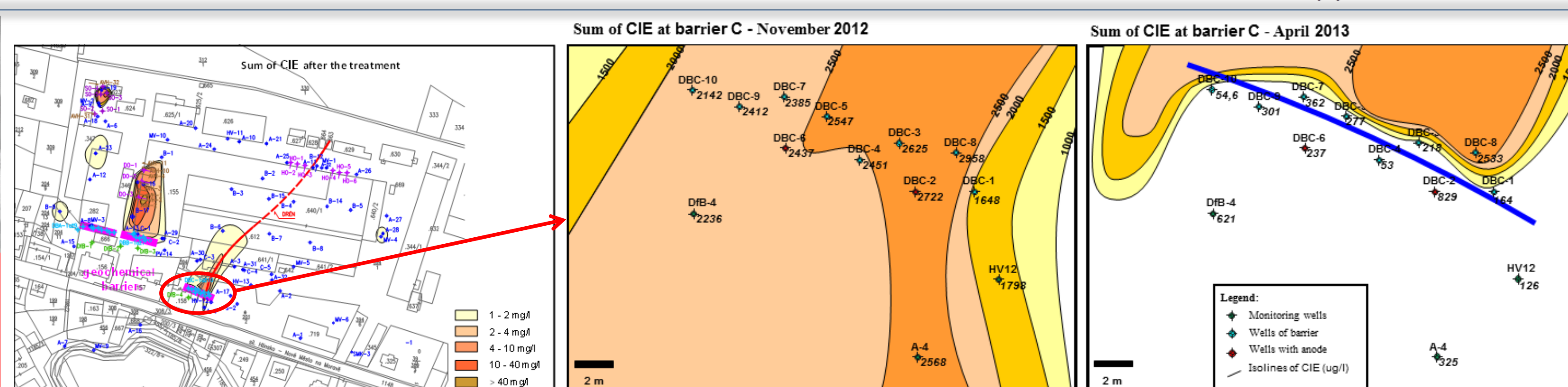
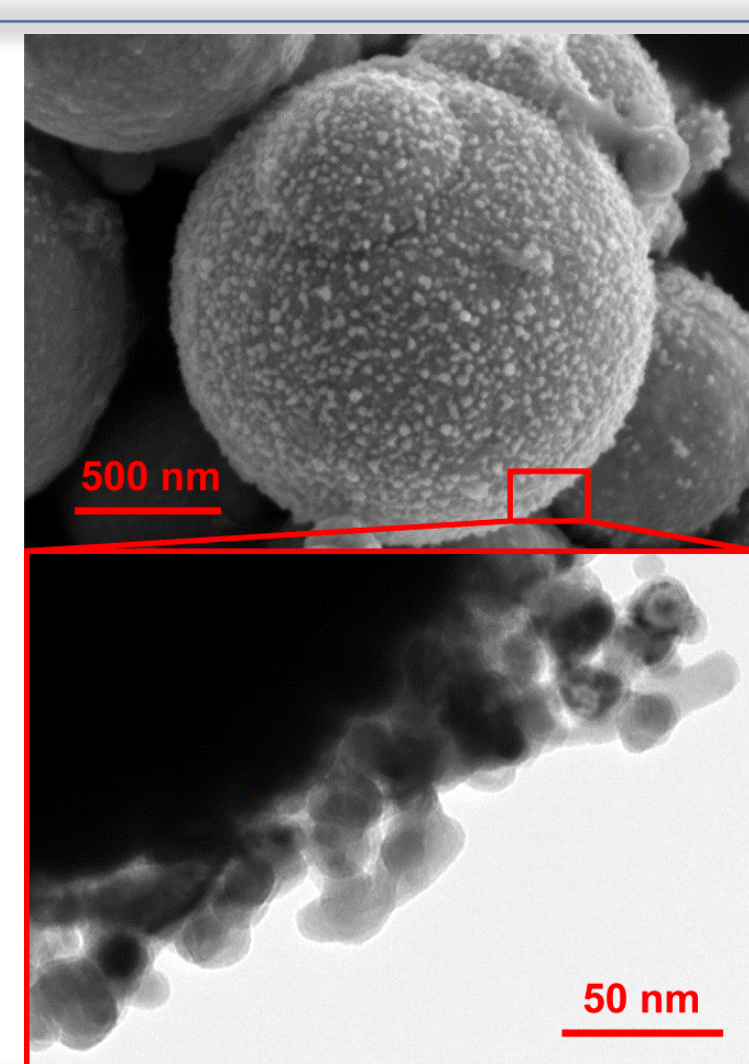


### Nano/Micro ZVI Composite



Synergetic effect on remediation ability:
• High and fast reactivity due to the ZVI nanoparticles
• Long-term reactivity due to ZVI microparticles

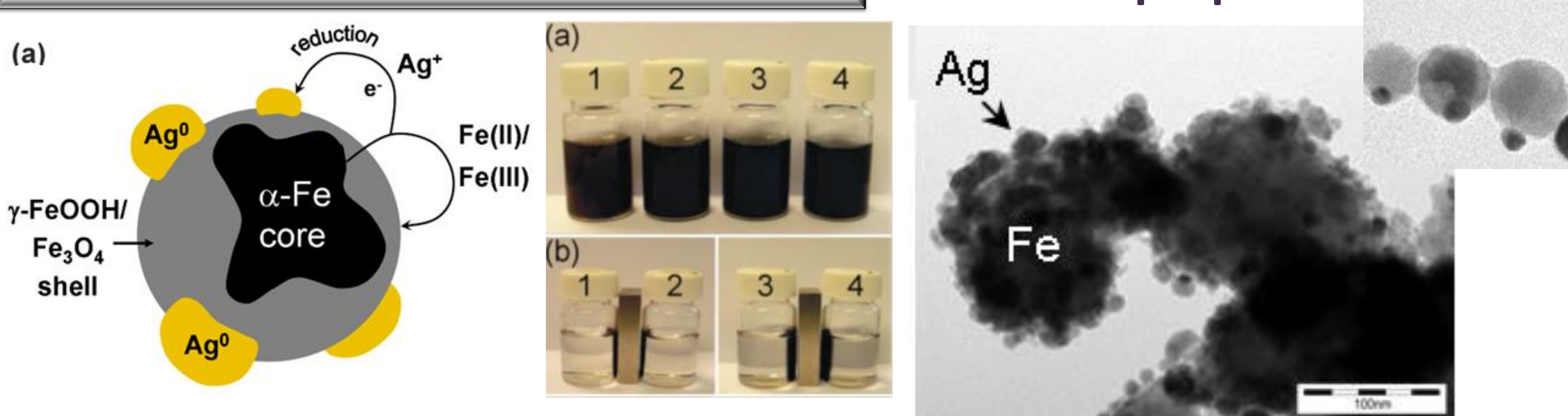
Czech Patent, Number 305170



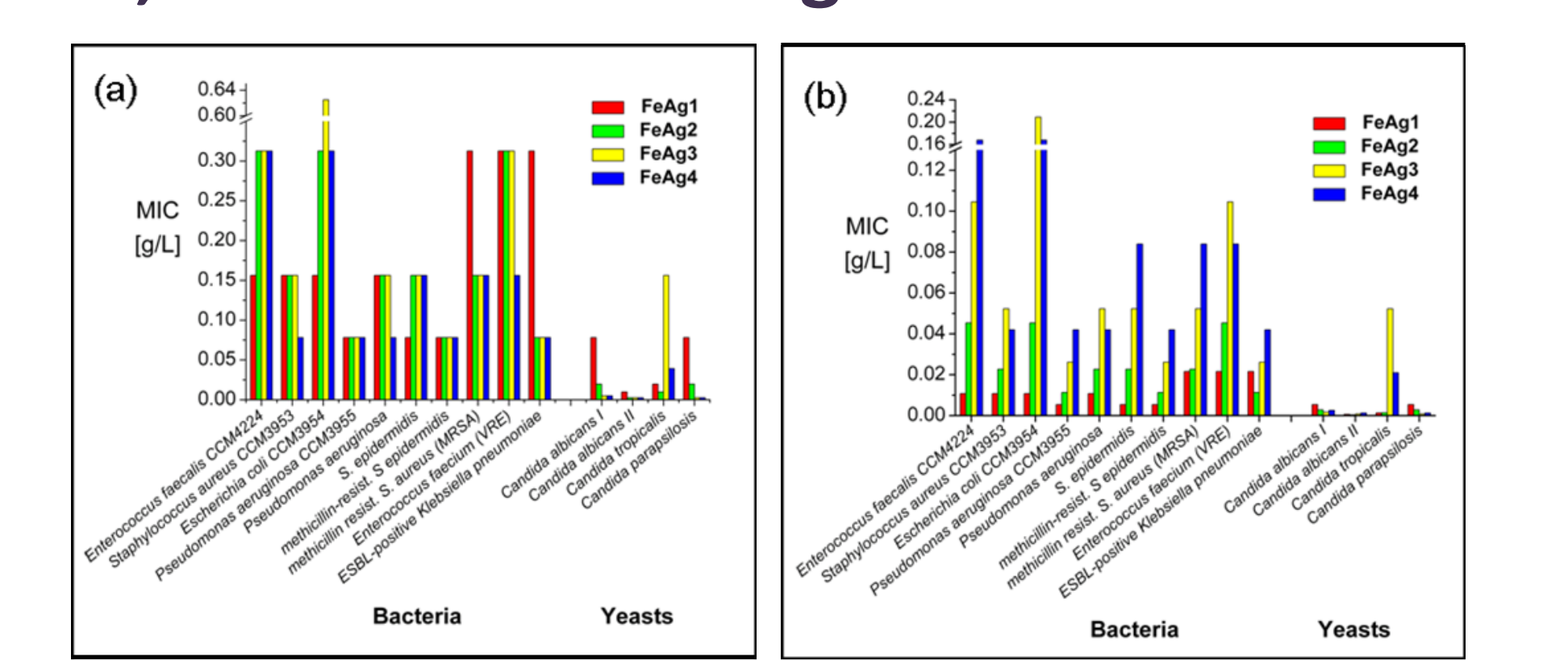
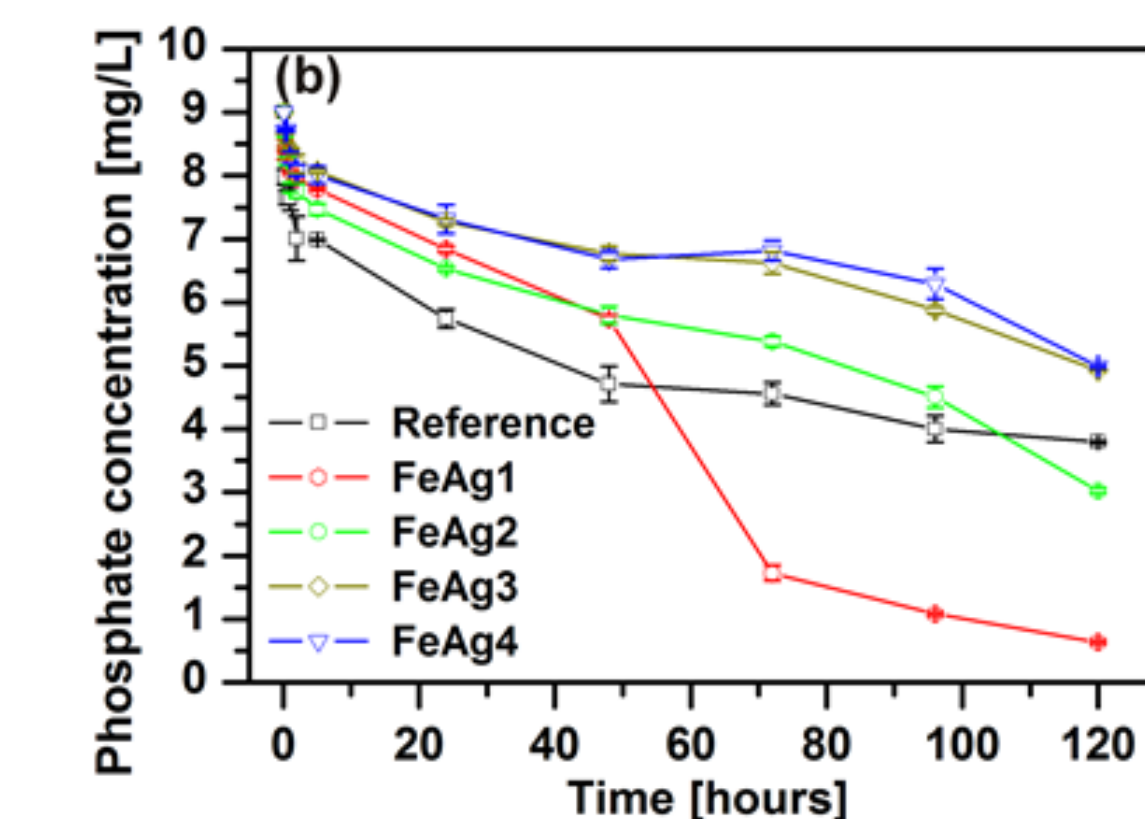
nZVI composite used in pilot application for construction of diffuse reactive barriers

### Bimetallic Fe-Ag nanocomposites

Enhanced properties due to the combination of antibacterial, reductive and magnetic characteristics!

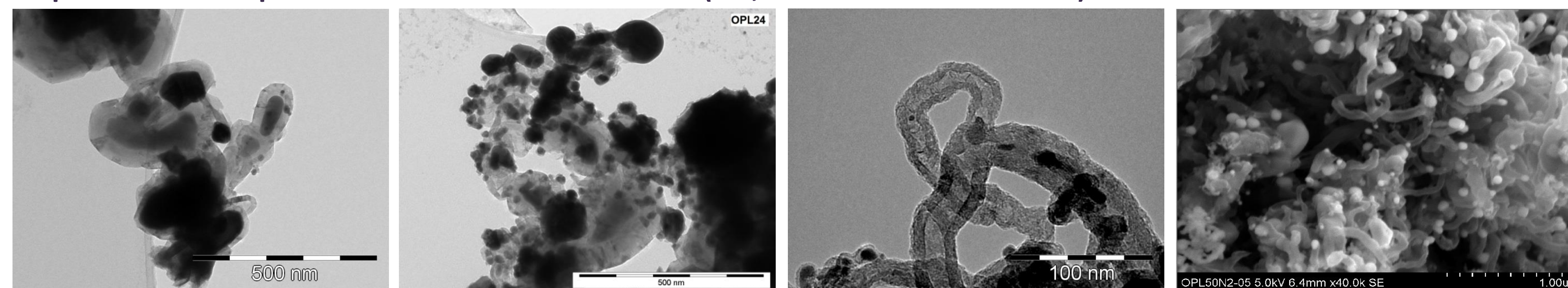


Marková Z. et al, Environ. Sci. Technol., 2013, 47 (10), pp 5285–5293

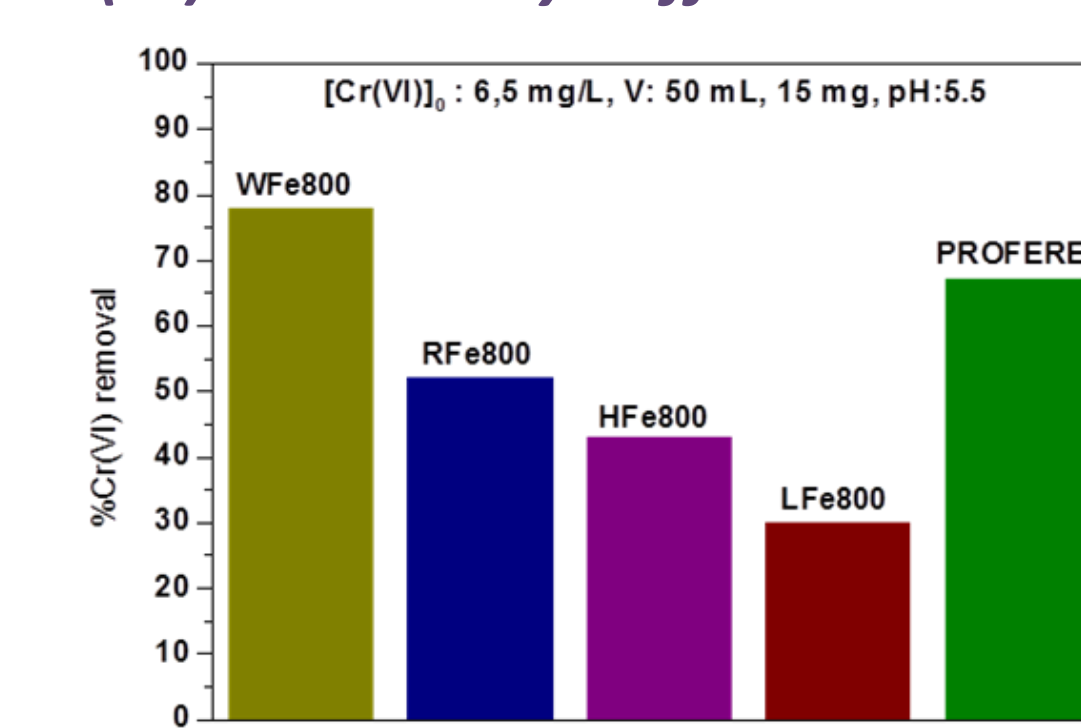


### Fe-C Composites

Preparation of composites based on nZVI and carbon (i.e., carbothermal reduction)



Cr(VI) removal by different Fe-C composites

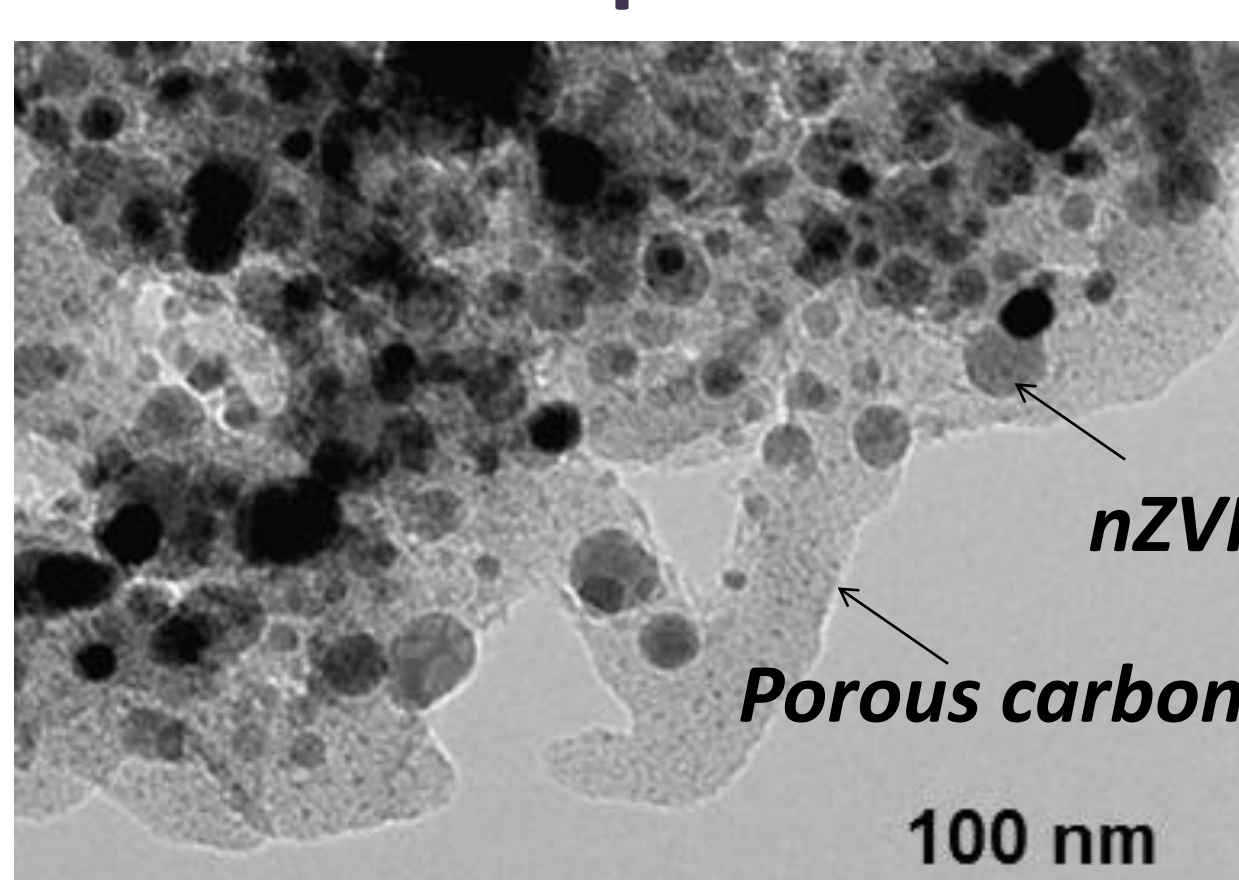


Fe-C composites are more resistant in iron oxidation, they have improved magnetic properties and exhibit high potential in a wide range of applications

### nZVI supported on different matrices

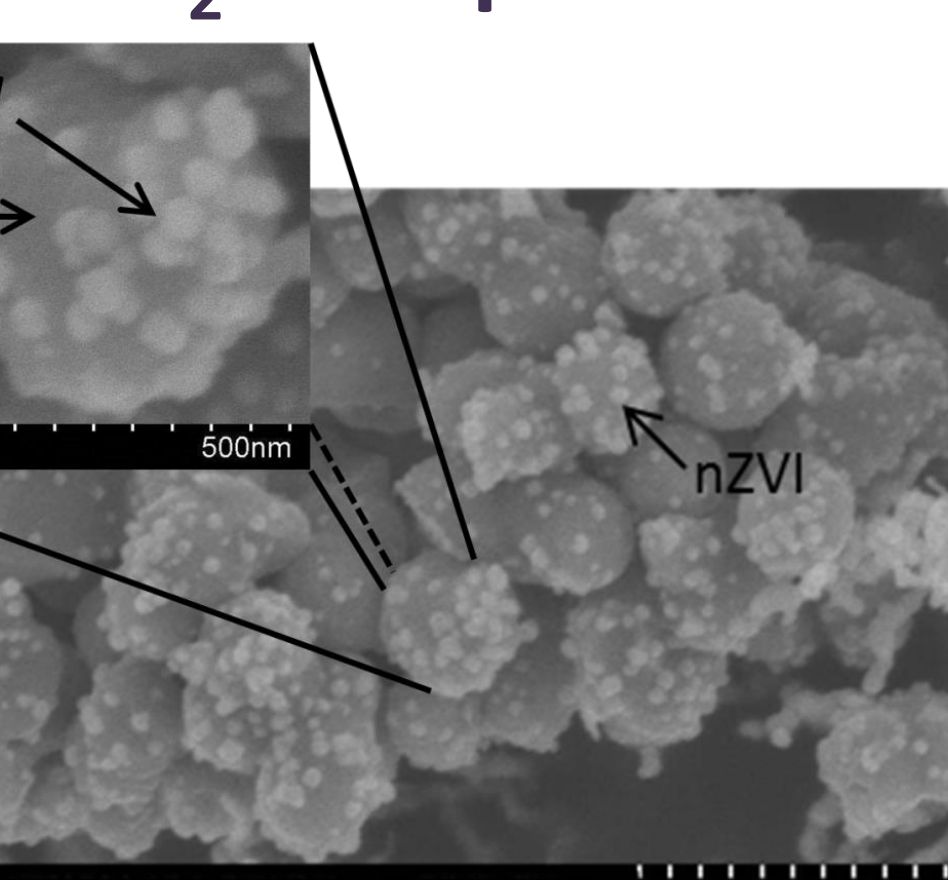
- In situ synthesis on nZVI on a support material
- Homogeneous dispersion
- Minimized agglomeration
- Fast and high rate on water treatment

#### Carbon mesoporous matrix



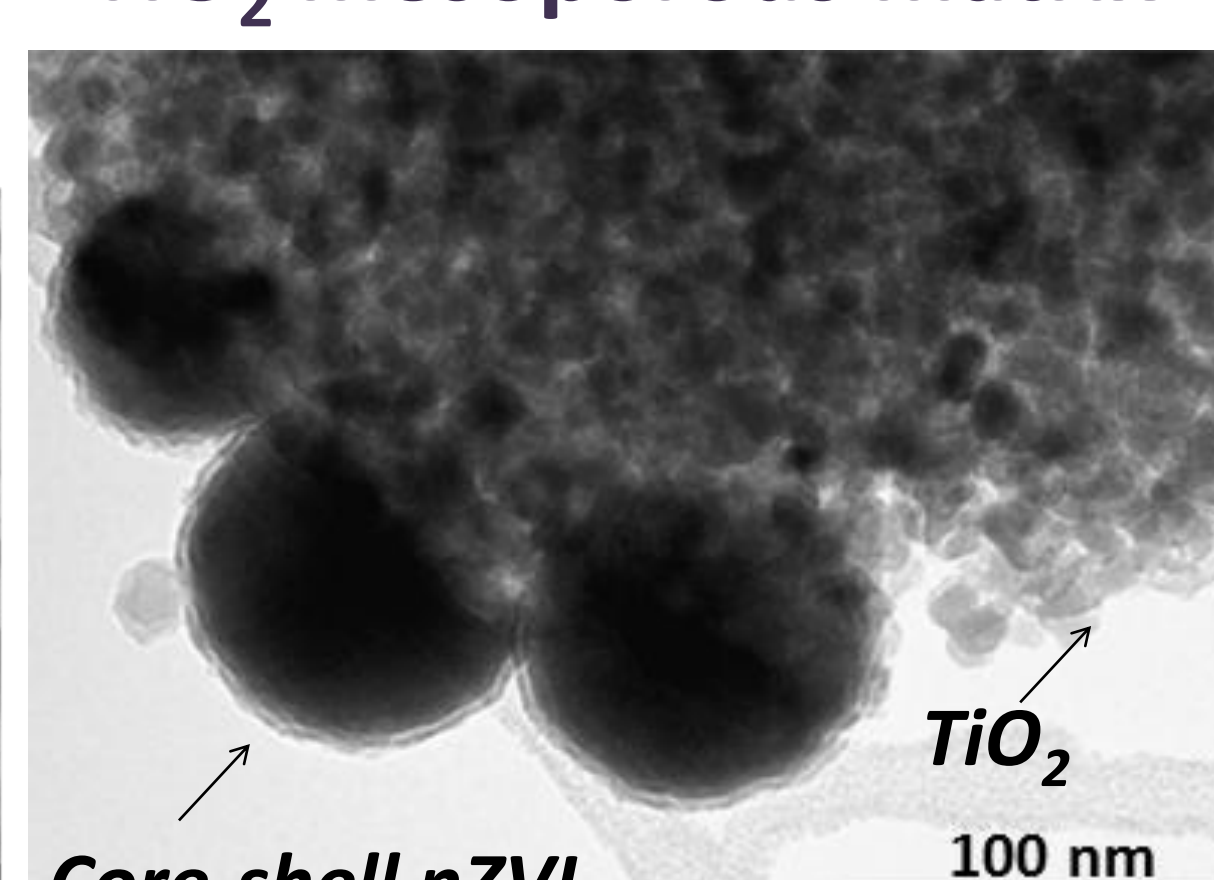
Baikousi M. et al, Manuscript in print, Carbon 2015

#### TiO2 nanoparticles

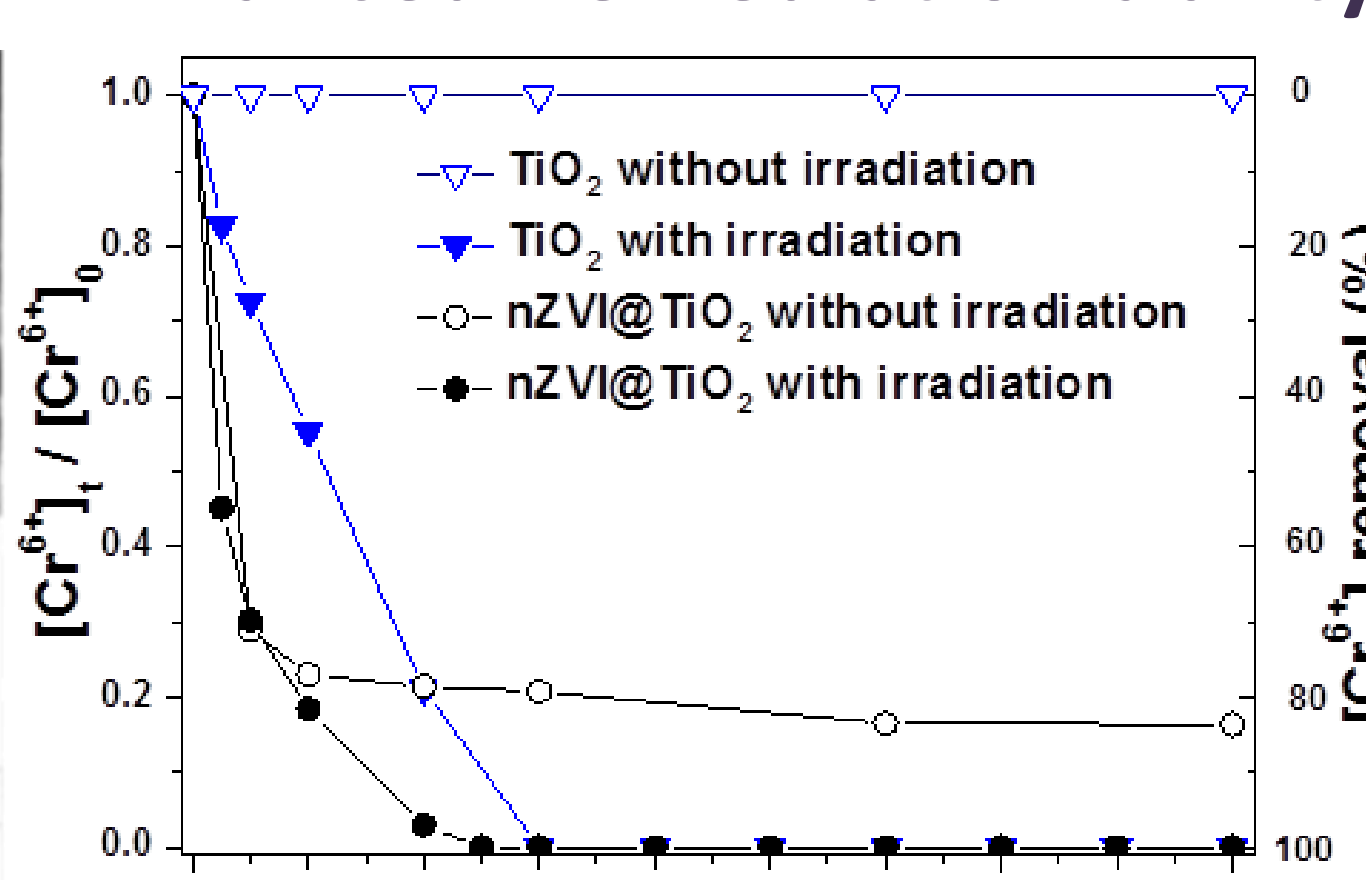


Petala E. et al, Submitted to Chemosphere

#### TiO2 mesoporous matrix



#### Enhanced Remediation ability



Project No. TE01020218

