Nanočástice (Anogranických materiálů vč. kovů a jejich slitin)

Audio test:

Start

Brno, PS 2012

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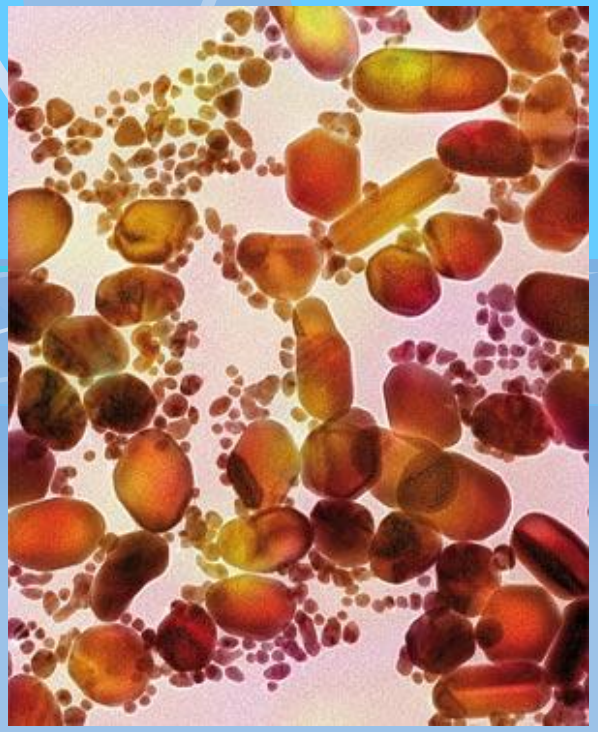
Ofice: UKB A12/M231

Ústav chemie: http://ustavchemie.sci.muni.cz/



Au-nano

Vybrané info o předmětu

- **Termín konání: Út 12,00-12,50**
- **Kredity 1**
- **Kreditová funkce:** Při ukončení předmětu zkouškou jsou přidány 2 kredity navíc, kolokviem 1 kredit navíc, při jiném typu ukončení student získá pouze kredity uvedené v rubrice Počet kreditů. (plus ukončení)
- Podmínky k získání klasifikace: ? Zkouška, test, samostatná práce, presentace na nano téma?.
- **Předmět alternuje k přednášce C6730 Fázové rovnováhy**

Osnova

- **Přehled vybraných vlastnosti nanočástic** - NPs (elektronová struktura,atomární klastry, krystalografie, geometrie nanoobjektů, hustota, elastické moduly, magnetické a optické vlastnosti, termodynamika tepelná kapacita a tepelná vodivost, kohezní energie, reaktivita, fázové přechody teploty a entalpie fázových transformaci v pevném stavu, tání a sublimace, povrchová a mezifázová energie, kohezní energie, ...).
- **Syntéza NPs** (bottom-up & down, syntéza z plynné fáze, pyrolýza, mokrá syntéza z~prekurzorů, práškové metody, vznik klastrů, separace a měření distribuční funkce NPs, ...).
- **Nanomateriály** (anorganické látky, nanoslitiny, kvantové tečky, pigmenty, nanokompozity,...).
- **Charakterizace NPs** (elektronová mikroskopie, spektrální metody, termické analýza,...).
- **Aplikace NPs** (senzory, katalýza, mechanické vlastnosti NPs, ...) Perspektivní použití (nanotechnologie, medicína,...).
- **Toxikologie a rizika NPs.**

Studijní materiály

- **Claudia Altavilla, Enrico Ciliberto: Inorganic Nanoparticles: Synthesis, Applications, and Perspectives (Nanomaterials and their Applications), CRC Press, 2011**
- **3. C.Bréchignac, P. Houdy, M. Lahmani: Nanomaterials and Namochemistry. Springer, 2007.**
- **J. Leitner: Struktura nanomateriálů, skripta VŠChT Praha, 2011: http://www.vscht.cz/ipl/nanomaterialy/Skripta/FCH_NANO_Struktura%20nanomaterialu.pdf,**
- 1. G. Cao: Nanostructures & Nanomaterials: Synthesis, Properties & Applications. Imperial College Press, London 2004.
- 2. E. Roduner: Nanoscopic Materials. Size-dependent Phenomena. RSC, Cambridge 2006.
- 4. G.L. Hornyak, J. Dutta, H.F. Tibbals, A.K. Rao: Introduction to Nanoscience. CRC Press, Boca Raton 2008.
- 5. D. Vollath: Nanomaterials: An Introduction to Synthesis, Properties and Applications, Wiley-VCH, 2008.
- 6. K.J. Klabunde, R.M. Richards (Eds.): Nanoscale Materials in Chemistry. 2nd.Ed., Wiley, Hoboken 2009.
- 7. A.I. Rusanov: Surface thermodynamics revisited, Surf. Sci. Report 58 (2005) 111-239.
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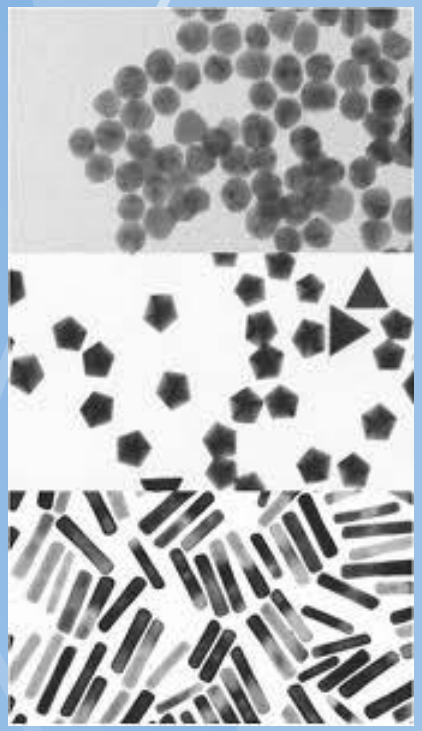

Metody syntézy Ag NPs

Literatura

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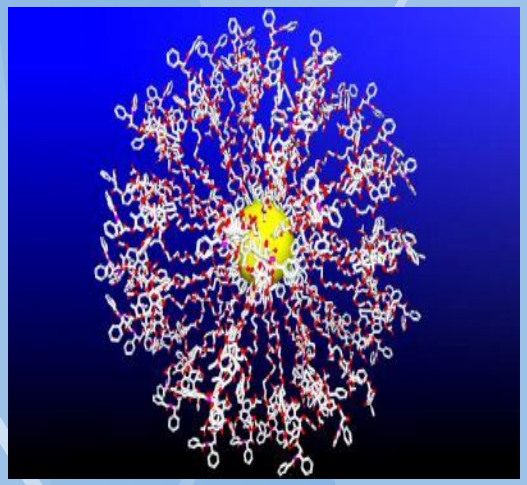
- 9. W. Haiss: Surface stress of clean and adsorbate-covered solids, Rep. Prog. Phys. 64 (2001) 591-648.
- 10. P. Müller, A. Saúl: Elastic effects on surface physics, Surf. Sci. Rep. 54 (2004) 157-258.
- 11. Q. Jiang, H.M. Lu: Size dependent interface energy and its applications, Surf. Sci. Rep. 63 (2008) 427-464.
- 12. T.P. Martin: Shells of atoms, Phys. Rep. 273 (1996) 199-241.
- 13. Z.L. Wang: Transmission Electron microscopy of shape-controlled nanocrystals and their assemblies, J.
- Phys. Chem. B 104 (2000) 1153-1175.
- 14. F. Baletto, R. Ferrando, Structural properties of nanoclusters: Energetic, thermodynamic, and kinetic
- effects, Rev. Modern Phys. 77 (2005) 371-423.
- 15. H. Gleiter: Nanostructured Materials: Basic consepts and microstructure, Acta Mater. 48 (2000) 1-29.
- 16. F.D. Fischer, T. Waitz, D. Vollath, N.K. Simha: On the role of surface energy and surface stress in phasetransforming
- nanoparticles, Prog. Mater. Sci. 53 (2008) 481-527.
- 17. Q. Jiang, S. Li: Thermodynamic considerations on solid structural transition temperatures of nanocrystals,



Funkcionalizace

Literatura

- J. Comput. Theor. Nanosci. 5 (2008) 2346-2364.
- 18. Q. Jiang, C.C. Yang: Size effect on the phase stabiliy of nanostructures, Current Nanosci. 4 (2008) 179-200.
- 19. C.X. Wang, G.W. Yang: Thermodynamics of metastable phase nucleation at the nanoscale, Mater. Sci. Eng.
- R 49 (2005) 157-202.
- 20. Q.S. Mei, K. Lu: Melting and superheating of crystalline solids: From bulk to nanocrystals, Prog. Mater.
- Sci. 52 (2007) 1175-1262.
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- (2009) 107-133.
- 22. G. Guisbiers, D. Ganguli (Eds.): Size effect in metals, semiconductors and inorganic compounds, Key Eng.
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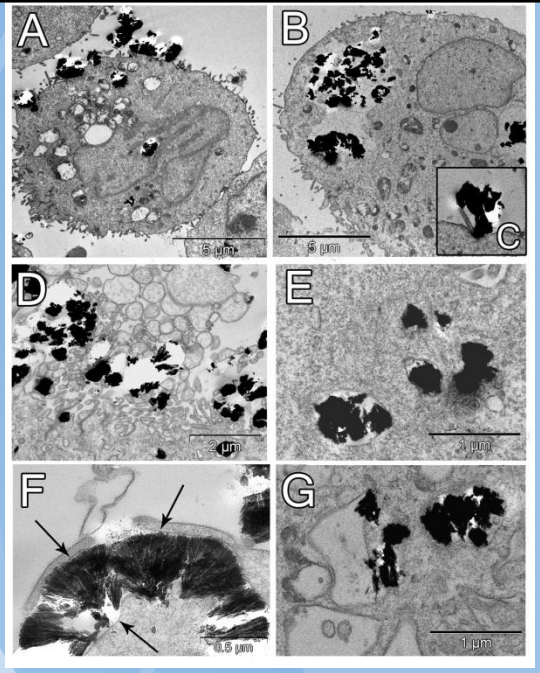
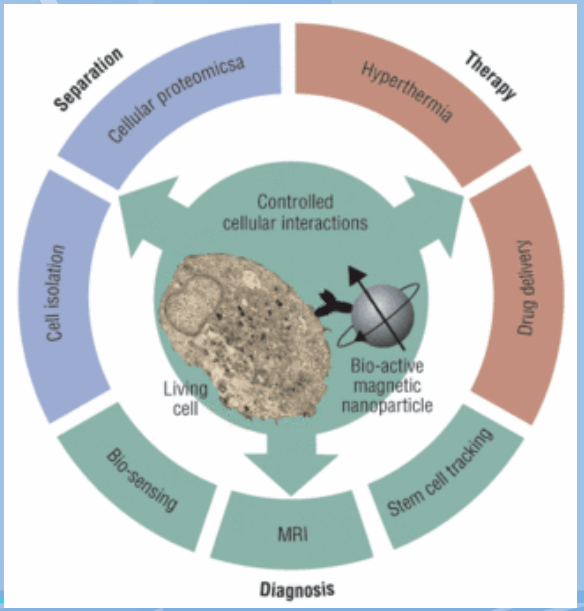
- Internet a WWW

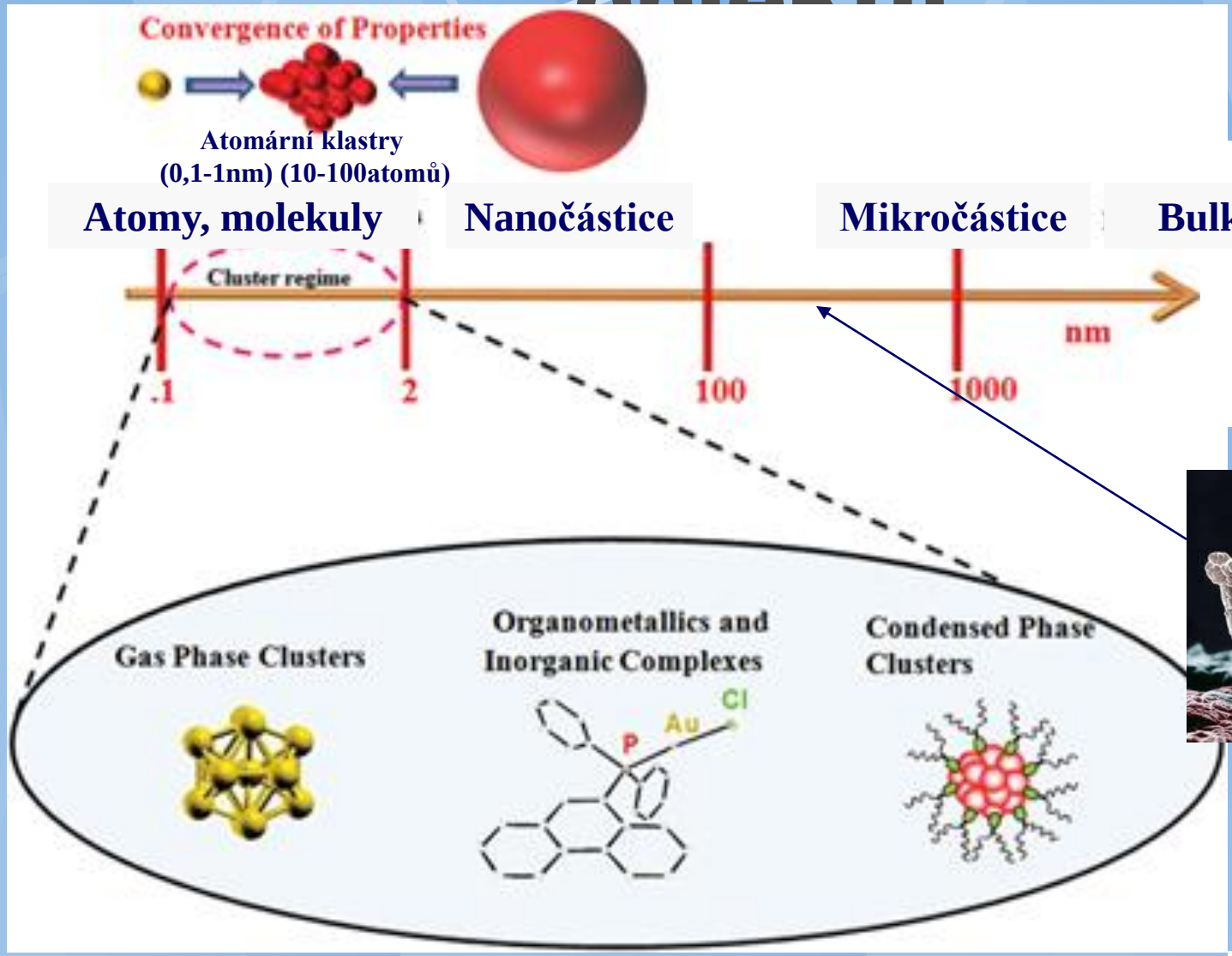


Marker



medicin

Nanočástice a měřítko objektů



HIV virus
(80nm)

http://www.nano-reviews.net/index.php/nano/article/view/14767/19584

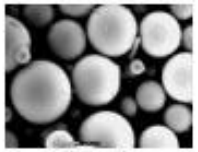
The Scale of Things – Nanometers and More

Things Natural

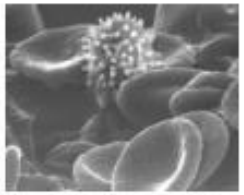
Dust mite
200 µm

Ant
~ 5 mm

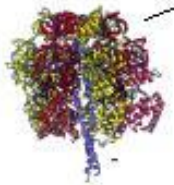
Human hair
~ 60-120 µm wide



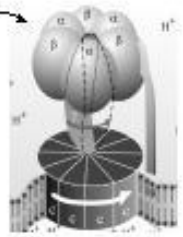
Fly ash
~ 10-20 µm



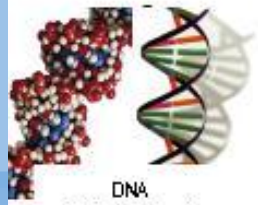
Red blood cells
with white cell
~ 2-5 µm



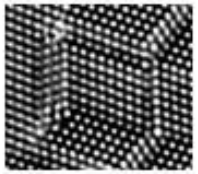
~10 nm diameter



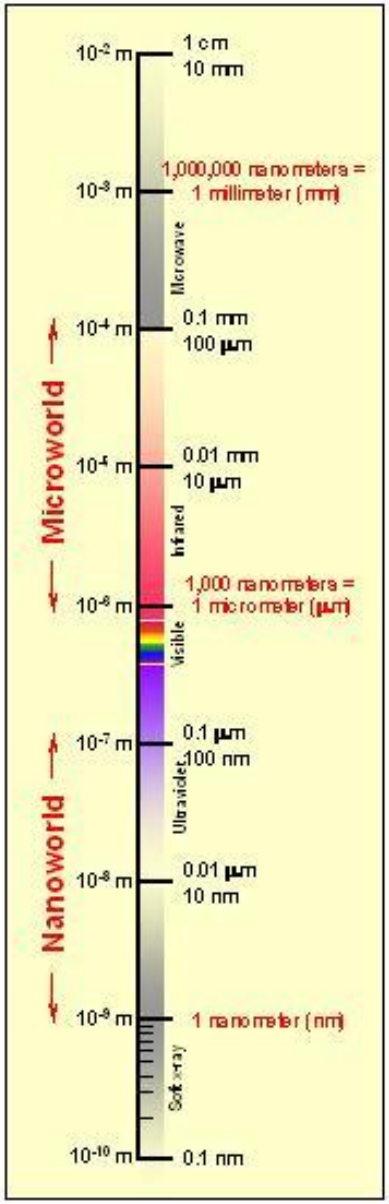
ATPsynthase



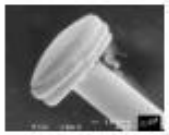
DNA
~2-12 nm diameter



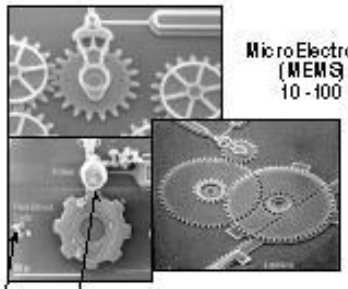
Atoms of silicon
spacing ~tenths of nm



Things Manmade

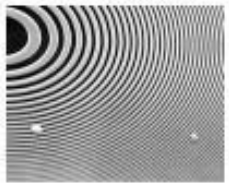


Head of a pin
1-2 mm

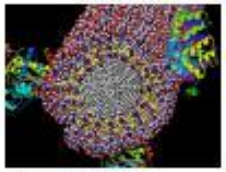


Micro Electro Mechanical
(MEMS) devices
10 -100 µm wide

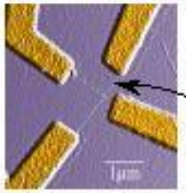
Pollen grain
Red blood cells



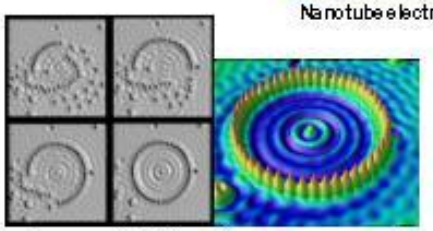
Zone plate x-ray "lens"
Outer ring spacing ~35 nm



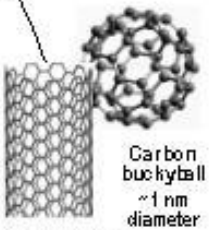
Self-assembled,
Nature-inspired structure
Many 10s of nm



Nanotube electrode



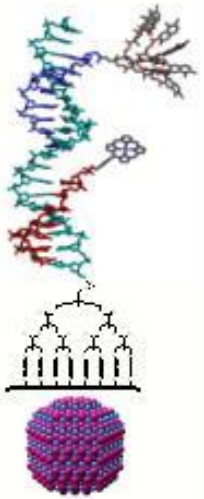
Quantum corral of 48 iron atoms on copper surface
positioned one at a time with an STM tip
Corral diameter 14nm



Carbon
buckyball
~1 nm
diameter

Carbon nanotube
~1.3 nm diameter

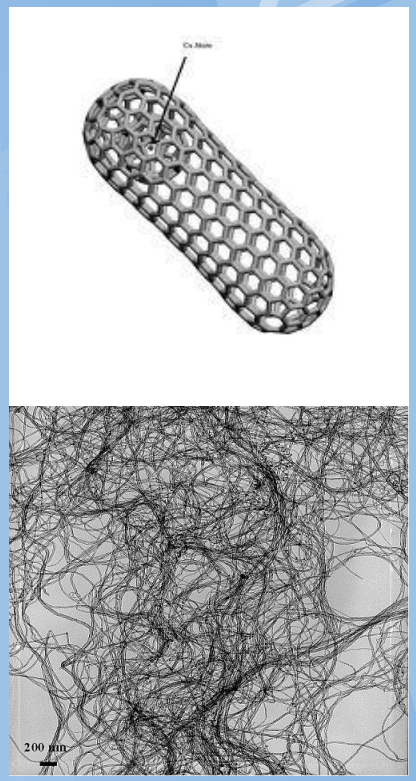
The Challenge



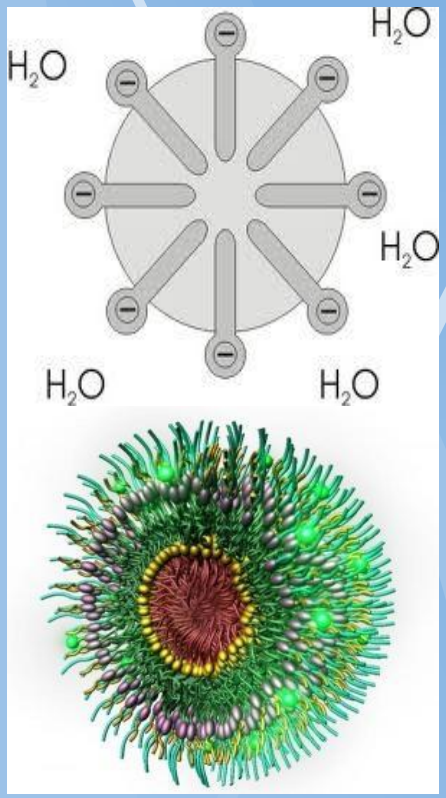
Fabricate and combine nanoscale building blocks to make useful devices, e.g., a photosynthetic reaction center with integral semiconductor storage.

Nanočástice a jejich variabilita

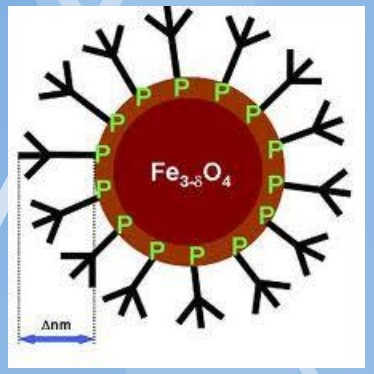
Carbon nanotubes

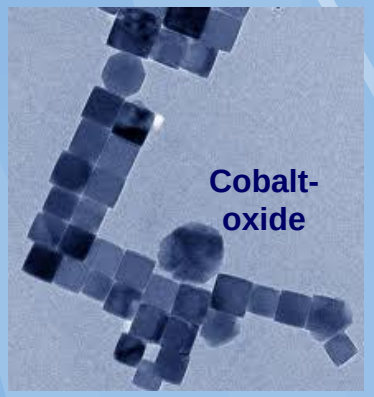


Micely

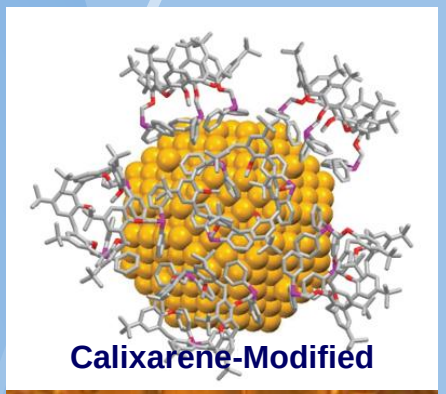


Oxidy

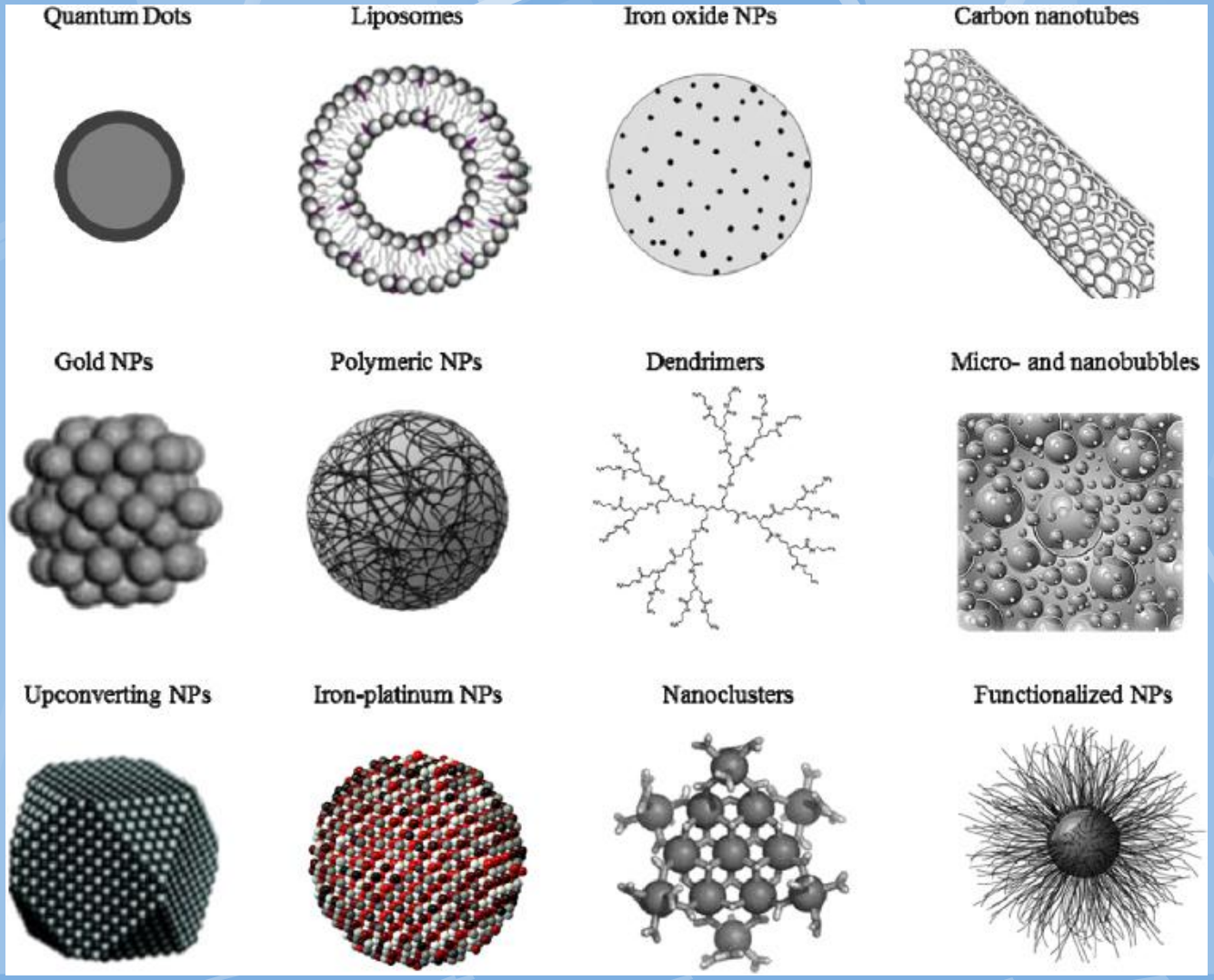




Kovy



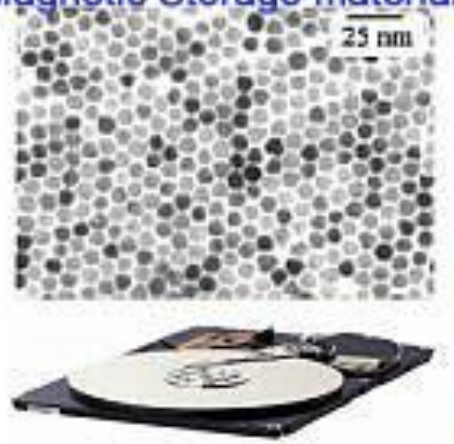
Další typy NPs



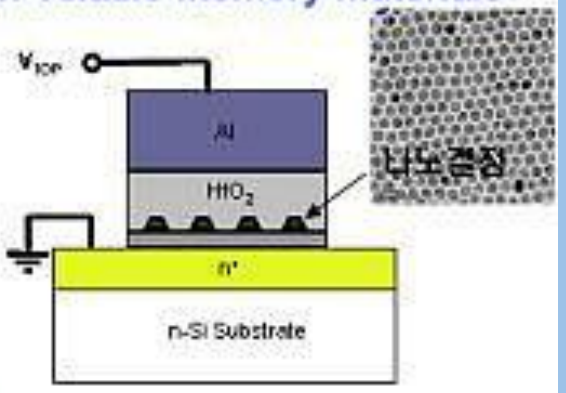
Řada vlastností NPs je podobná s vlastnostmi tenkých nanovrstev.

Motivace studia NPs

High density
Magnetic Storage materials

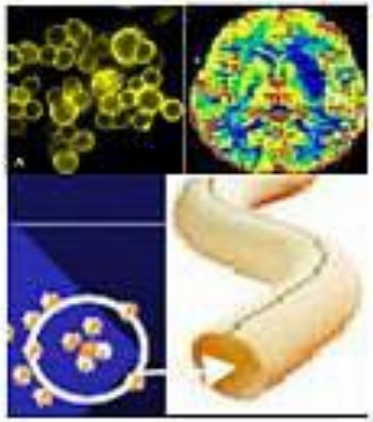


Next Generation
Non-volatile memory materials

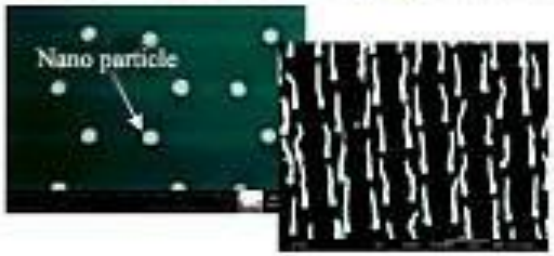


Metal Nanocrystals

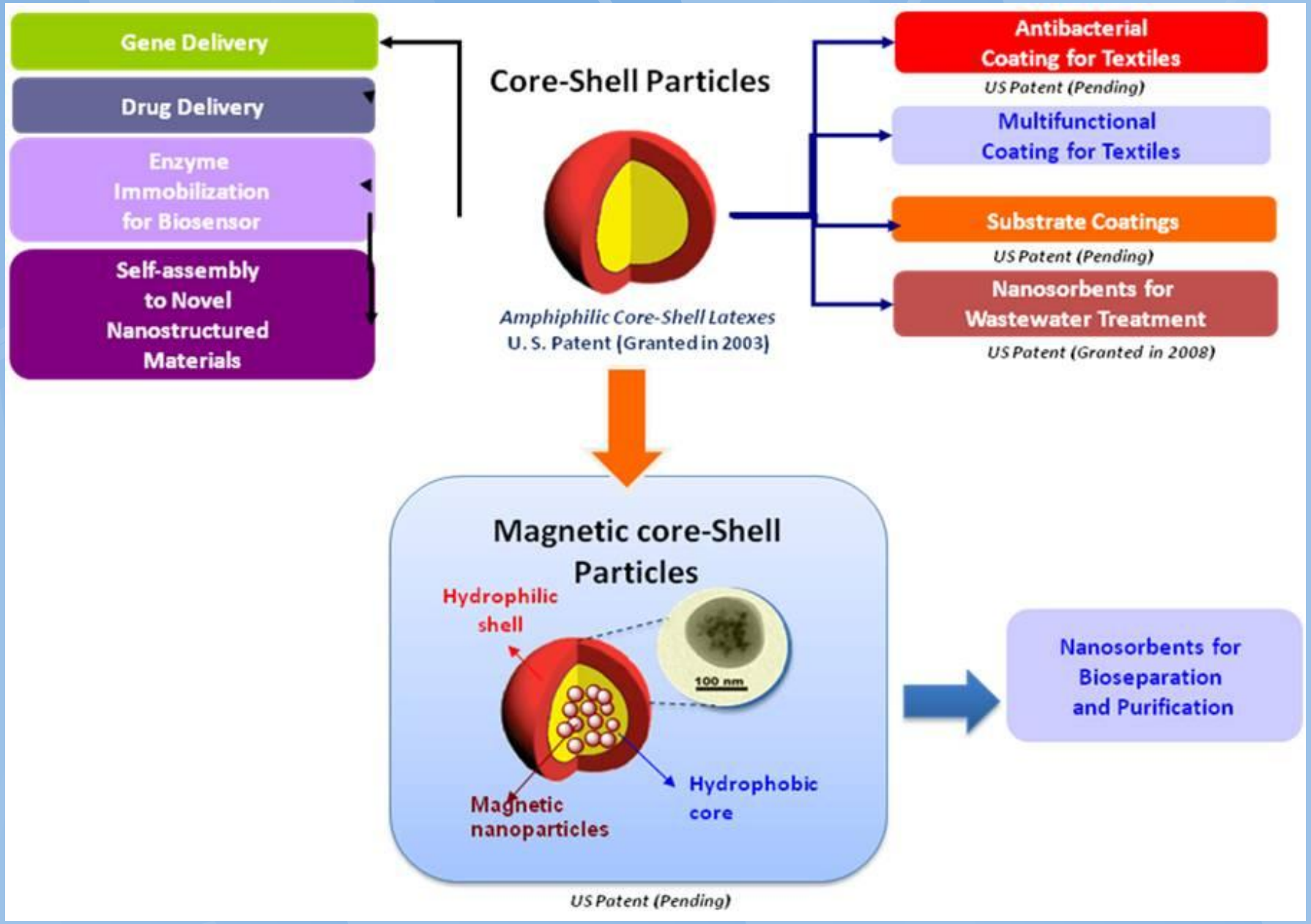
Drug Delivery System
and Medical materials



Next Generation Display materials



Next Generation
Hydrogen Storage materials


Gene Delivery
Drug Delivery
Enzyme Immobilization for Biosensor
Self-assembly to Novel Nanostructured Materials
Core-Shell Particles
Amphiphilic Core-Shell Latexes
U. S. Patent (Granted in 2003)
Antibacterial Coating for Textiles
US Patent (Pending)
Multifunctional Coating for Textiles
Substrate Coatings
US Patent (Pending)
Nanosorbents for Wastewater Treatment
US Patent (Granted in 2008)
Magnetic core-Shell Particles
Hydrophilic shell
100 nm
Hydrophobic core
Magnetic nanoparticles
US Patent (Pending)
Nanosorbents for Bioseparation and Purification

Profesní růst

CEITEC
central european institute of technology
BRNO | CZECH REPUBLIC

Doc. Kaiser: X-ray Micro CT aand nano CT, http://www.ceitec.eu/programs/advanced-nano-and-microtechnologies/x-ray-micro-ct-and-nano-ct/

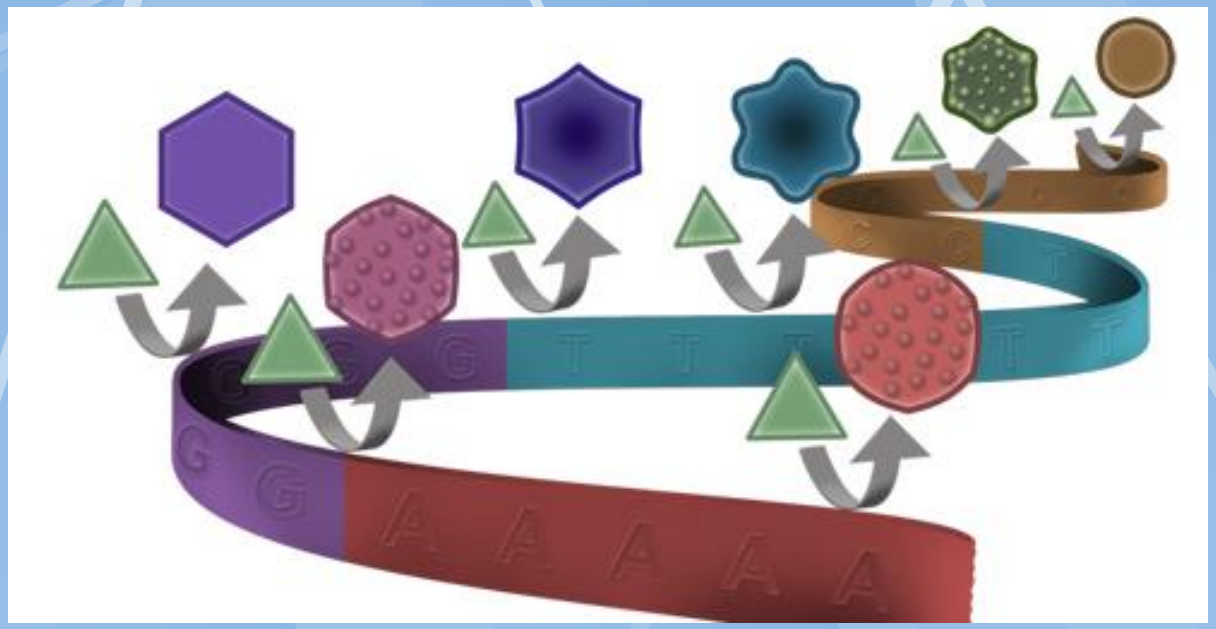
Prof. Šikola, CEITEC VUT, Advanced Nano and Mikro technologies

Synthesis and Analysis of nanostructures

CEITEC: http://www.ceitec.muni.cz/index.php

Diskuse

- DNA kontrola tvaru Au-nano ?????



http://nextbigfuture.com/2012/08/dna-can-shape-gold-nanoparticle-growth.html