MPL – RBI

GENERAL PRESENTATION

- **Complete denomination**: Molecular Physics Laboratory (MPL), Division of Materials Physics, Ruđer Bošković Instiute (RBI) and collaborating partners
- **Location (city, country)**: Zagreb, Croatia
- **Director**: Tomo Antičić
- **Contact person in NEWGEN**: Andreja Gajović
- **Working Group involvment**: WG2
- **Staff**: 3 senior scientists, 3 research associetes/assistant prof., 1 research assistant, 4 PhD students
- **Research topics**: bioactive ZrO_2 based ceramics (syntheses and structural characterization), interaction of CaP coatings with substrates (structural characterization), bioactive glasses (surface activity of electrically polarised bio-glasses), dental materials (electrical and dielectric properties)
- **Researchers expertises**: Raman spectroscopy (*in situ*, micro/macro), TEM (collab with IJS), impendence spectroscopy

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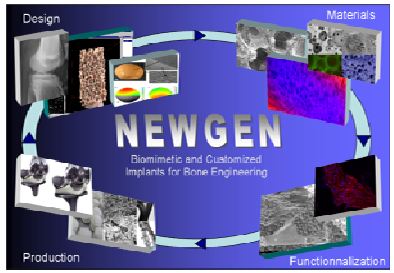
Ruđer Bošković Instiute
Bijenička 54
HR-10002, Zagreb - CROATIA



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COMPETENCES OF THE GROUP

Characterization:

- ADVANCED:
  - *in situ* thermo micro-Raman spectroscopy (RS)
  - Impedance spectroscopy (IS)
  - TEM methods – collaboration with IJS (Ljubljana)
- BASIC:
  - X-ray powder diffraction
  - scanning electron microscopy
  - dynamic light scattering (sizes in range 0.6-6000 nm and ξ potential)

Syntheses of ceramics:

- SOLID STATE:
  - mechanochemistry
  - sintering
- WET CHEMISTRY:
  - hydrothermal methods
  - anodization
  - sol-gel syntheses

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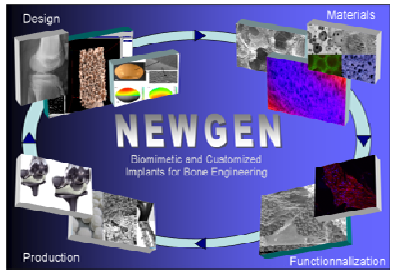

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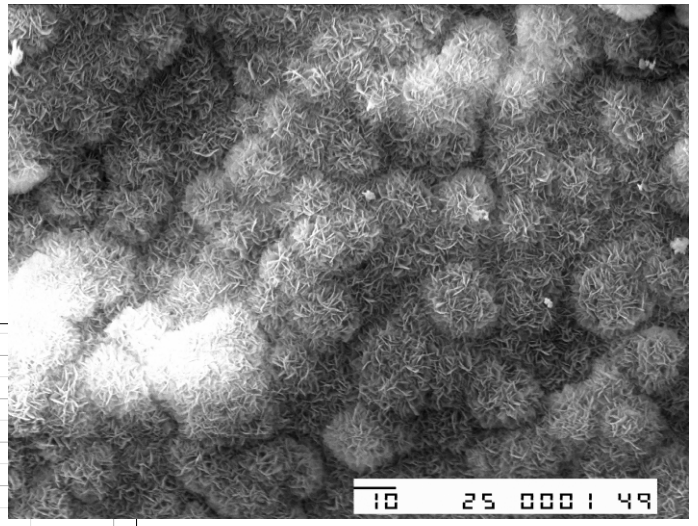
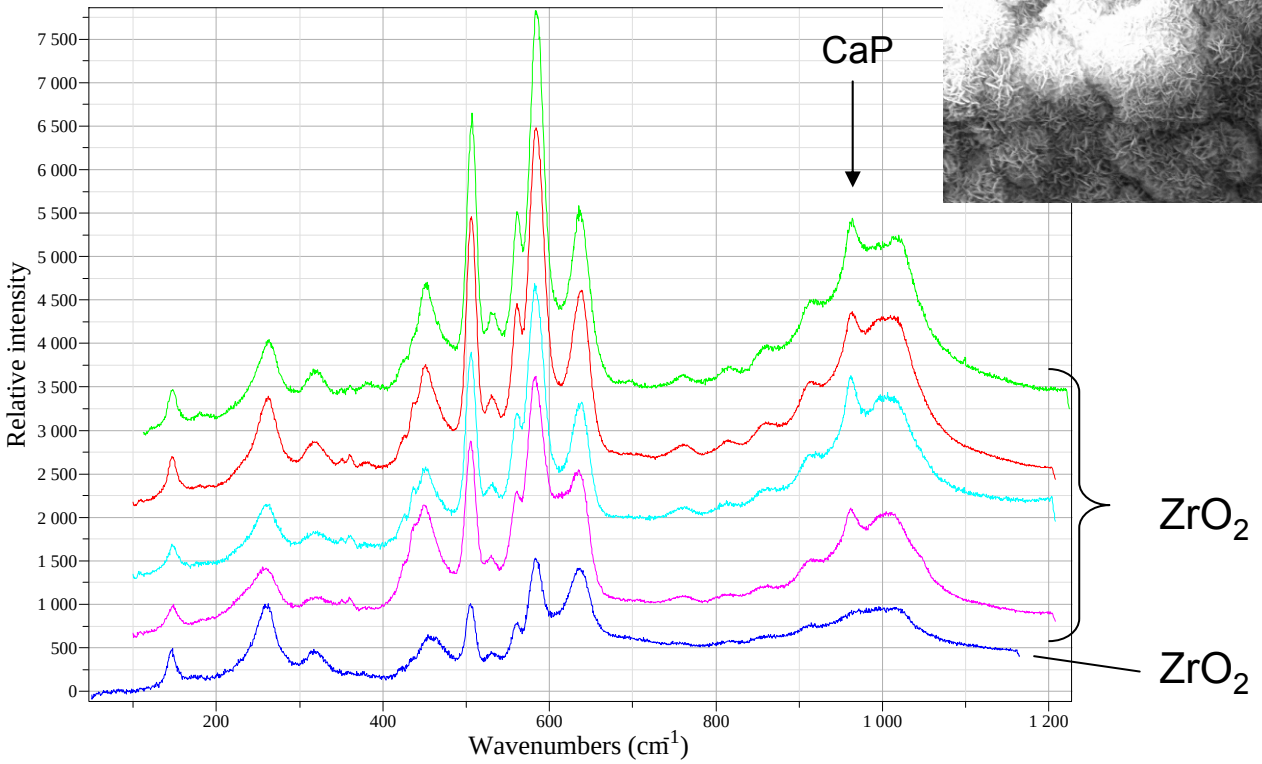
BIOMATERIALS/NEWGEN TOPIC 1

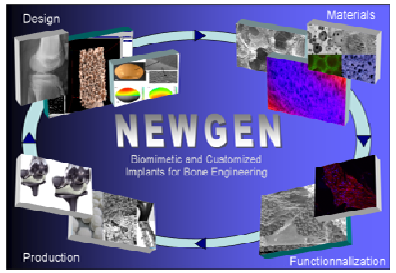
Stabilized ZrO_2 ceramic with CaP coating

Materials: sol-gel or mechanochemical syntheses of ZrO_2 powder + sintering

Methods: Raman spectroscopy and SEM







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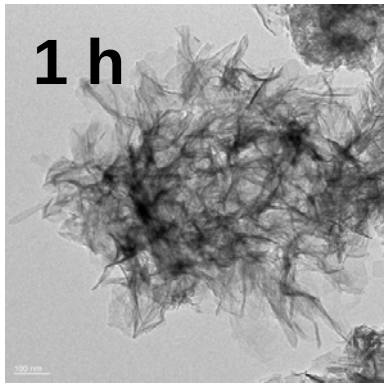
BIOMATERIALS/NEWGEN TOPIC 2

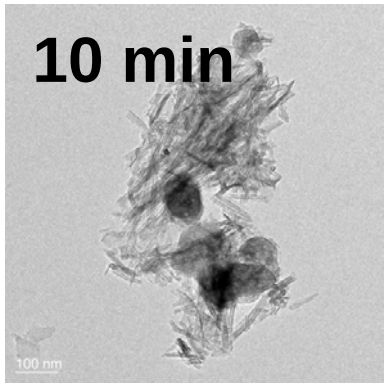
Influence of the titanate ($H_2Ti_3O_7$) nanotubes (TiNT) on the CaP phase formation

The difference in the Raman spectra of amorphous calcium phosphate (ACP), octacalcium phosphate (OCP) and hydroxy apatites (HAP) → shift in the bands' maxima and the decrease of the bands' broadness (FWHM).

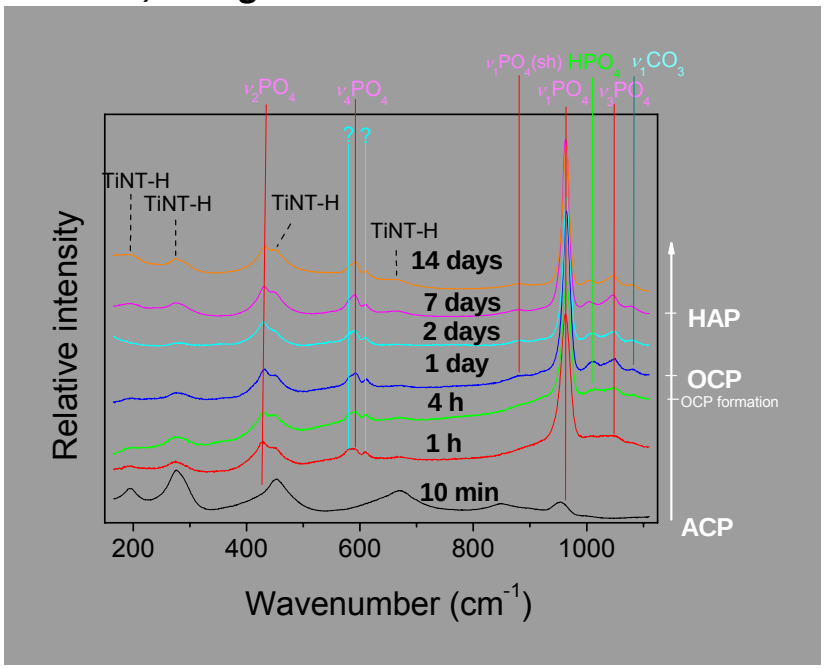
Materials: hydrothermal syntheses of TiNT, biomimetic CaP

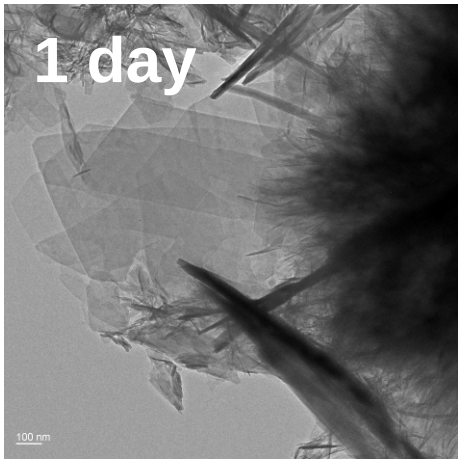
Methods: Raman spectroscopy and TEM

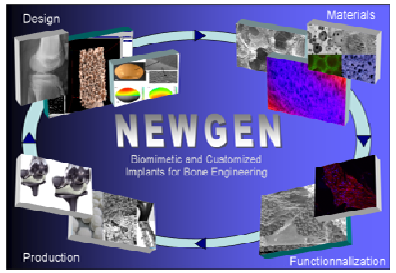




CaP + 0,03 mg/mL TiNT







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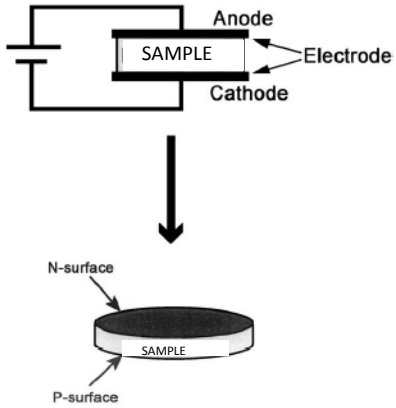
BIOMATERIALS/NEWGEN TOPICS

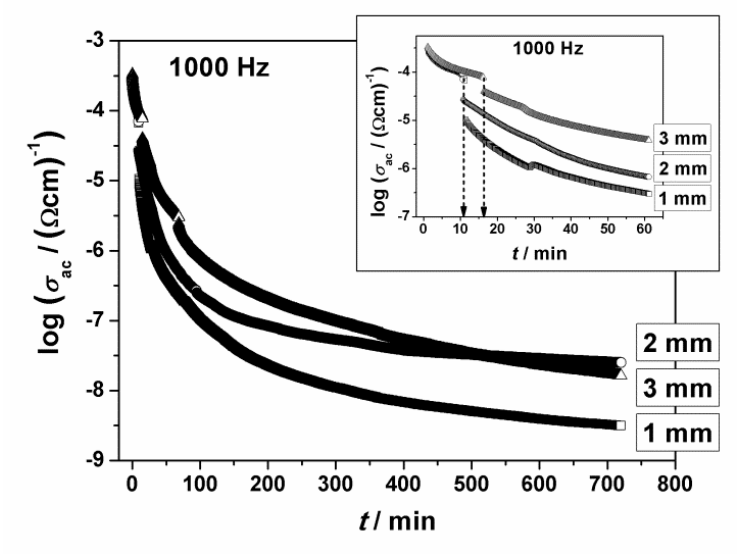
Topic 3: Electrical polarization of bioactive glasses

Materials: commercial bioactive glasses 45S5, 13-93

Method: thermally stimulated polarization/depolarization current

- Influence of surface charges induced by electrical polarization on bioactivity

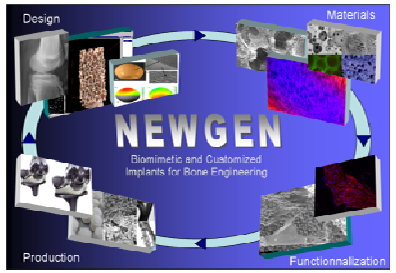




Topic 4: Characterization of the setting process and aging of dental materials

Materials: glass ionomer cements, dental resins

Method: Impedance spectroscopy study of electrical/dielectric properties of dental materials



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FACILITIES

Advanced Raman spectroscopy technique

514.5 or 532 nm excitation

- triple monocromator, CCD camera
- confocal micro-Raman stage and macro-Raman stage

Temperature dependent *in situ* measurements, 10 K – 1700 K:

- He-cycle cryostat: 10 K – 350K (macro stage)
- “Linkam” 77 K – 800 K (micro stage)
- “Leitz” heating stage: 500 – 1700 K (micro stage)

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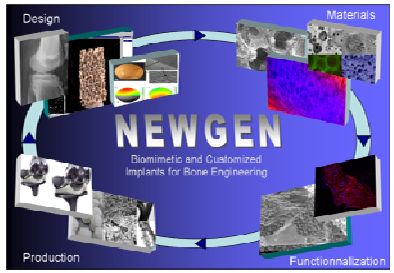

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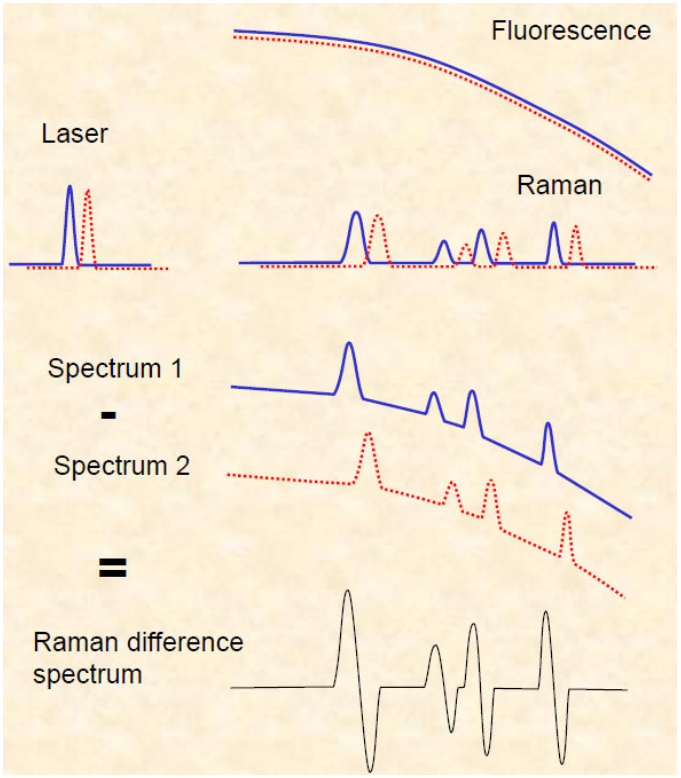
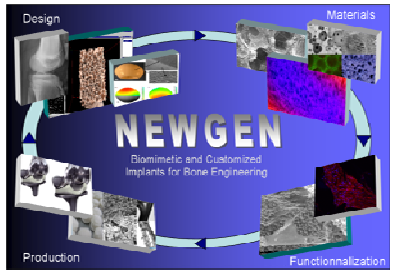
Portable Raman spectroscopy technique

Florescence problem in the organic materials is solved by SERDS



Lasers'power	0 - 0.5 W
Laser 1	**784.3 nm**
Laser 2	**785.2 nm**



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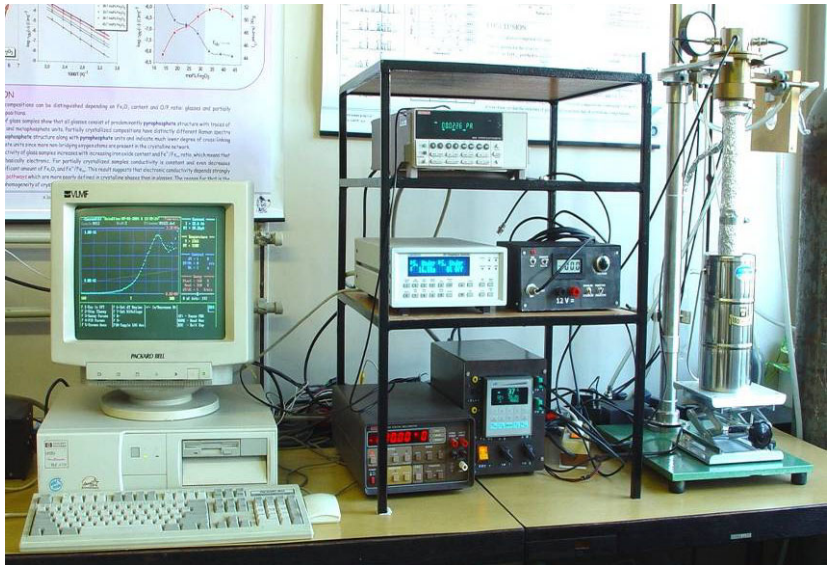
FACILITIES

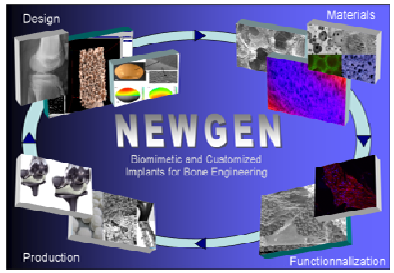
Electrical measurements

Impedance spectroscopy (IS) - Impedance analyzer (Novocontrol-Alpha N) with high-temperature sample cell:

- frequency range: 1 mHz – 4 MHz,
- temperature range: -100°C– 1100°C



Setup for measuring thermally stimulated polarization/depolarization current (TSPC/TSDC)



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