Óbuda University

Doctoral School of Materials Sciences and Technologies

ELKH, Centre for Energy Research,
Institute of Technical Physics and Materials Science

Development and structural characterization of calcium-silicate based bioceramics

PhD student :

Maroua Houria Kaou

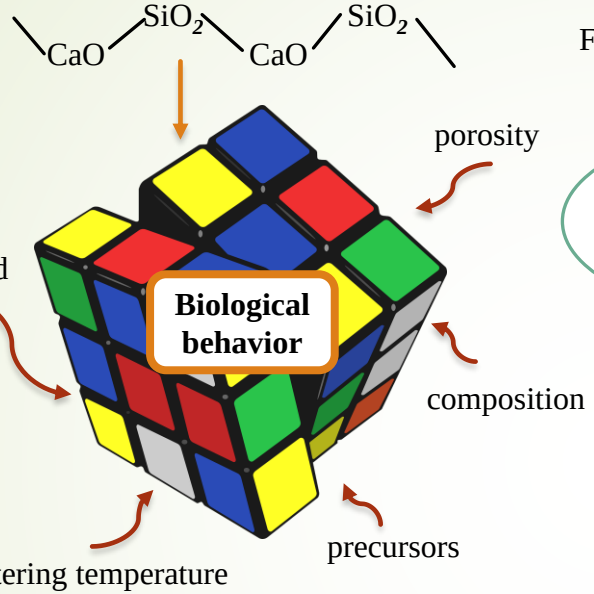
Supervisors:

Dr. Csaba Balázsi

Dr. Katalin Balázsi

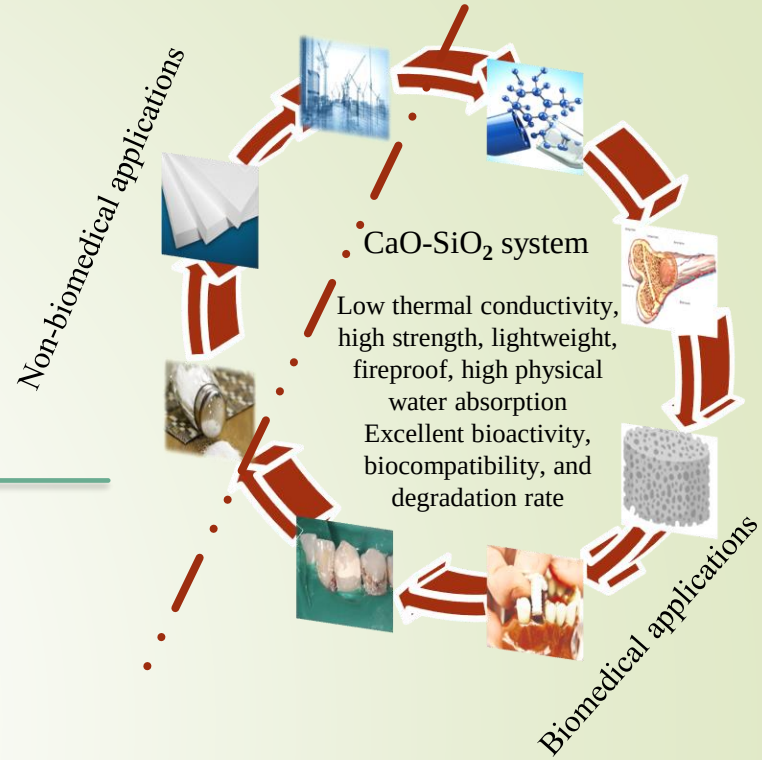
2022/2023

Calcium Silicates (CaO-SiO_2)

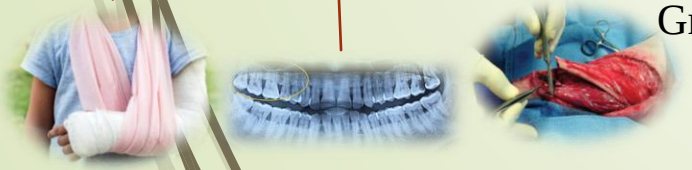


Formation of an apatite layer

CaO-SiO2 ceramics

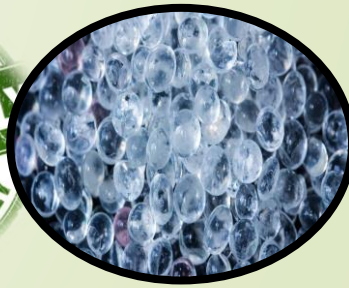


New approach has been trending !!!



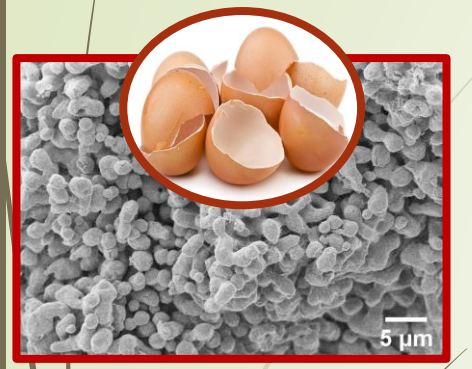
Natural wastes as raw materials

Green environment synthetic routes



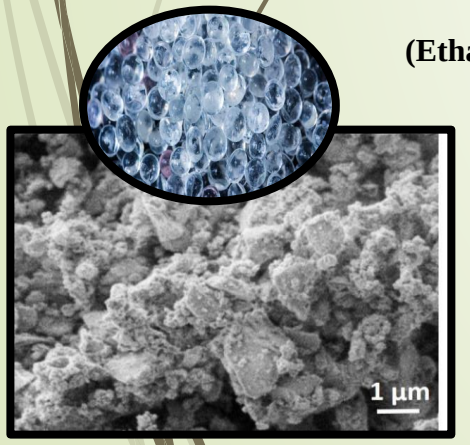
Flashback from the previous semester

CaO



Heat Treatment (12h, 900 °C)

Milled silica



Ball Milling (3h, 10 balls of alumina)

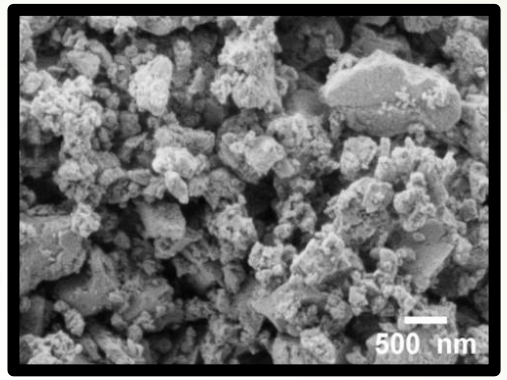
Attrition milling (3h)

(Ethanol, 2000 rpm) + (PEG, 500 rpm)

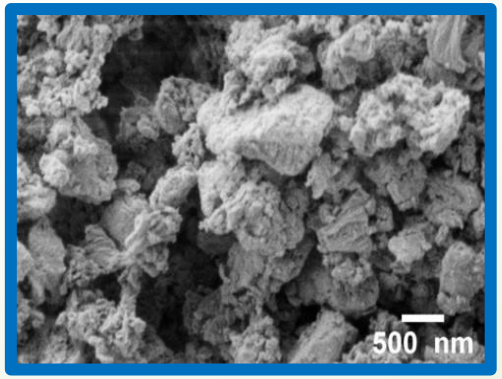
CaO

SiO2

10C90S



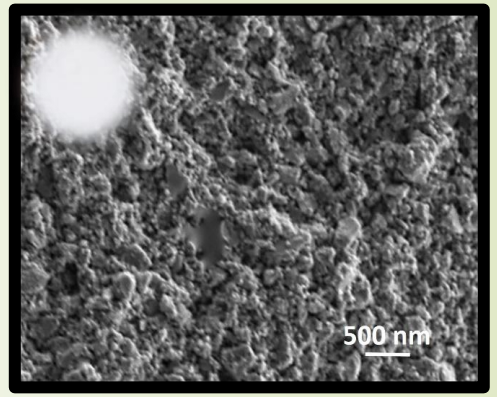
50C50S



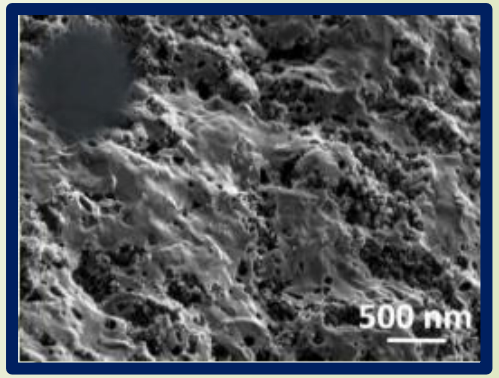
Pressing at room temperature in a dry condition under 18MPa

Heat treatment in the air at 800 ° C for 1h

10 wt% CaO /90 wt% SiO_2

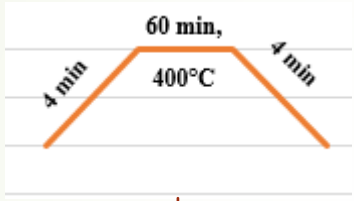


50 wt% CaO /50 wt% SiO_2



Preparation of ceramic discs

PEG evaporation



Sintering under 70 MPa for 10 min at 700 °C, 800 °C, and 900 °C

50C50C, Vacuum, 70 MPa, 400 ° C, 1h

50C50C, Vacuum, 70 MPa, 700 ° C, 10 min

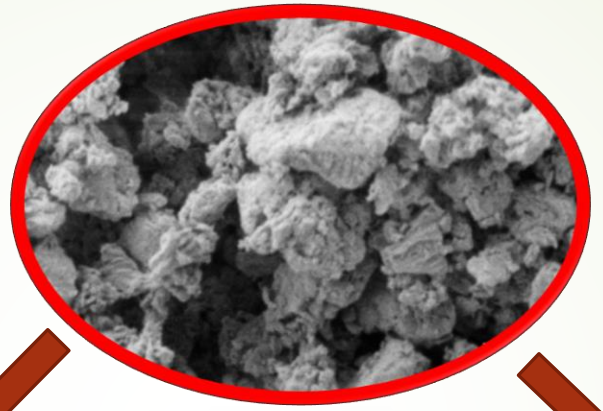
50C50C, Vacuum, 70 MPa, 800 ° C, 10 min

50C50C, Vacuum, 70 MPa, 900 ° C, 10 min

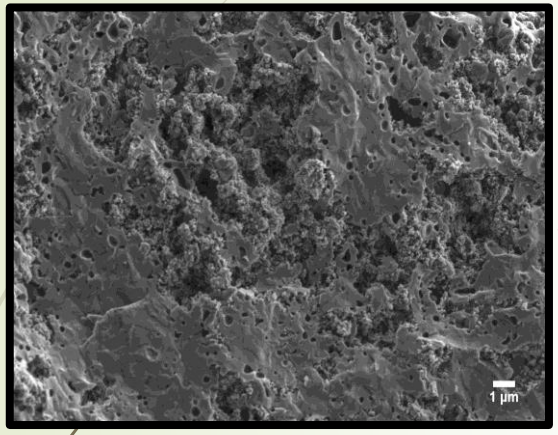
10C90C, Vacuum, 70 MPa, 800 ° C, 10 min

10C90C, Vacuum, 70 MPa, 900 ° C, 10

Morphological investigations of ceramic discs for the composition 50C50S

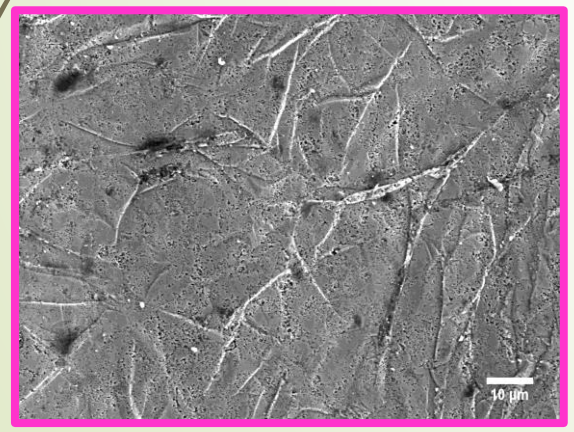


50C50S Powder

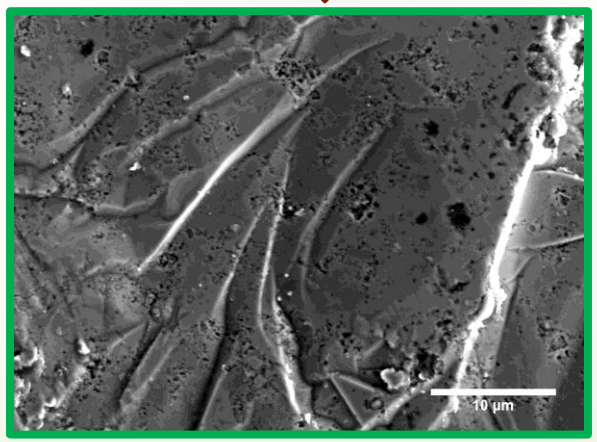


Reference, 50C50C, Air, 18 MPa, 800 ° C, 1h

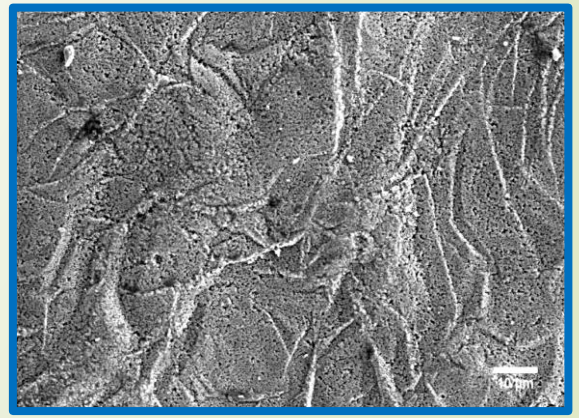
50C50C, Vacuum, 38.84 MPa, 400 ° C, 1h



50C50C, Vacuum, 70 MPa, 900 ° C, 10 min

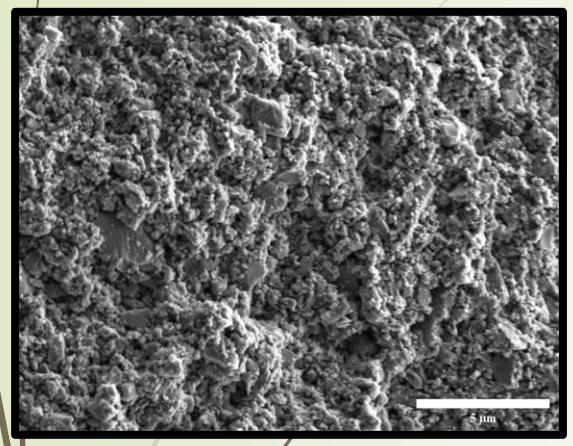


50C50C, Vacuum, 70 MPa, 800 ° C, 10 min

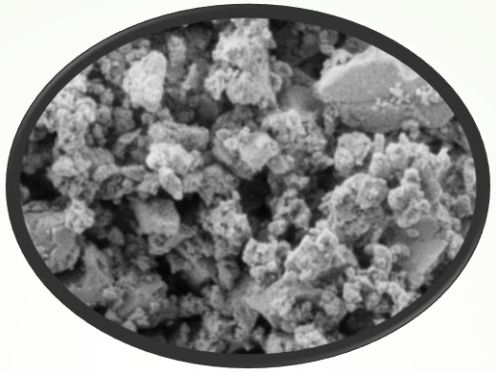


50C50C, Vacuum, 70 MPa, 700 ° C, 10 min

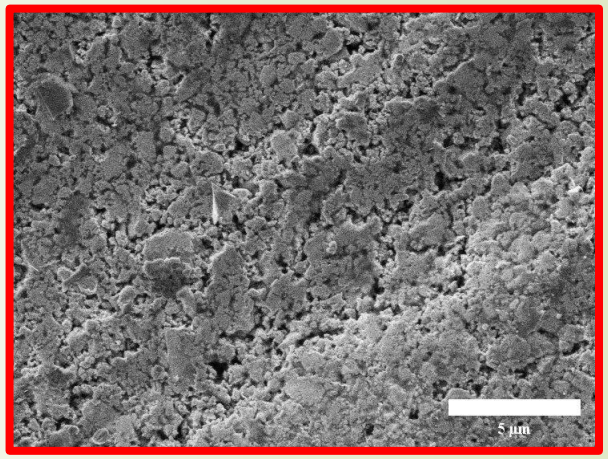
Morphological investigations of ceramic discs for the composition 10C90S



10C90C, Air, 18 MPa, 800 ° C, 1 min, Reference

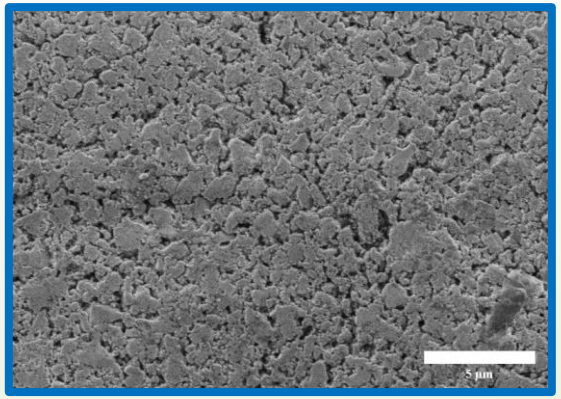


10C90S Powder



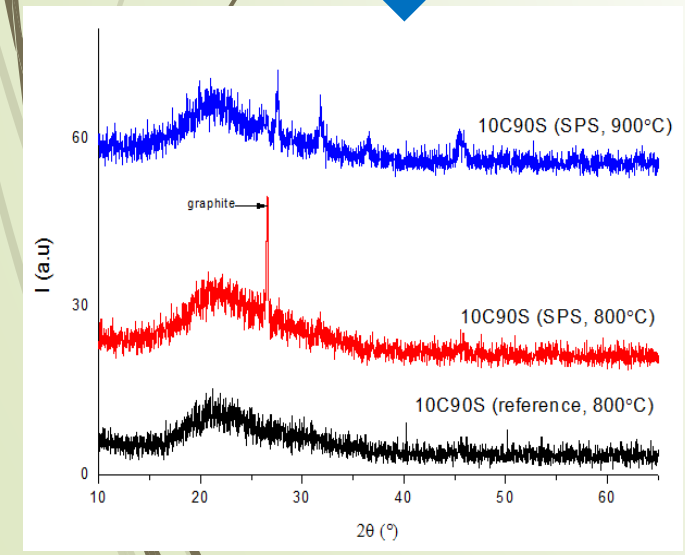
10C90C, Vacuum, 70 MPa, 800 ° C, 10 min

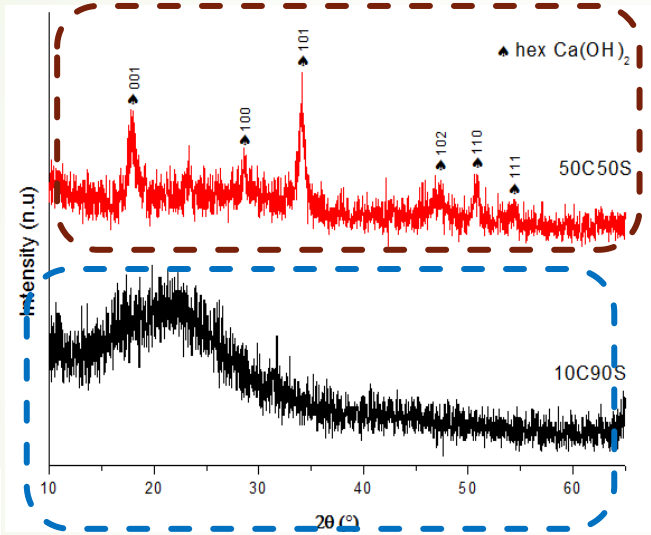
10C90C, Vacuum, 70 MPa, 900 ° C, 10 min



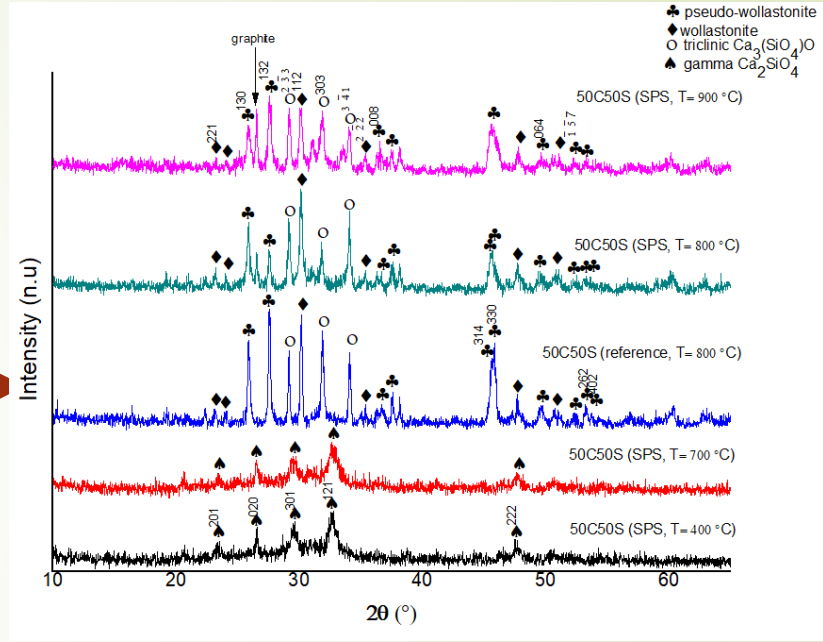
Effect of sintering on powder mixtures

After sintering for 10 min





After sintering for 10 min



XRD patterns of calcium silica ceramics

Results

1. Semester:

1) Powder technology (Dr. Balázsi C.)

2) Biomaterials for medical applications (Dr. Balázsi C.)

3. Semester:

1) Fracture mechanics (Dr. Kovács T. A)

2) Composites (Dr. Klébert Sz.),

3) Hungarian II (Dr. Szloboda József Sándorné K.)

2. Semester:

1) Transmission electron microscopy for structural investigations of different materials (Dr. Balázsi K.)

2) Selected chapters of material testing methods I. (Dr. Takács E, Dr. Judit Telegdi)

3) Hungarian I (Dr. Szloboda József Sándorné K.)

4. Semester:

1) Cellulose chemistry (Dr. Borsa Judit)

2) Synthetic fibres and textiles (Dr. Borsa Judit)

Presentations and publications

Publications:

[1] Kaou M. H., Horváth Z. E., Balázsi K., Balázsi C. Eco-friendly preparation and structural characterization of calcium silicates derived from eggshell and silica gel. Int. J. Appl. Ceram. Technol. 2022; 1-11. https://doi.org/10.1111/ijac.14274

Conferences:

1) Participated in [Virtual] European Congress and Exhibition On Advanced Materials and Progress - (EUROMAT 2021), September 12-16 (Poster).

2) Participated in [Virtual] 46th international Conference and Exposition on Advanced Ceramics and Composites (ICACC 2022), January 23-28 (Poster).

3) Participated in Ceramics In Europe (ECerS 2022) conference, July 10-14 (Poster).

4) Participated in [Virtual] ACerS Pan American Ceramics Congress (PACC-FMAs 2022), July 24-28 (Poster).

5) Participated in International Hybrid Conference on Nano Structured Materials and Polymers (ICNP), May 12-14 (Invited talk, virtual).

Research Plan

Next steps:

- ✓ **Preparing 4 manuscripts.**
- ✓ **Preparing ceramic discs at 900 C and 1000 C and carrying out their different investigations.**
- ✓ **Conducting the biological test for all the samples by immersing them in SBF solution for different periods.**

Thank you for your attention!