IIC SAS

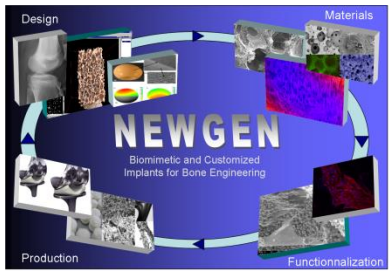
GENERAL PRESENTATION

IIC SAS
Dúbravská cesta 9
845 36 Bratislava,
SLOVAKIA

- **Complete denomination**: Institute of Inorganic Chemistry, Slovak Academy of Sciences
- **Location (city, country)**: Bratislava, Slovakia
- **Director**: Professor Miroslav Boča
- **Contact person in NEWGEN**: Professor Pavol Šajgalík
- **Working Group involvment**: Ceramic Department (Pavol Šajgalík)
- **Staff**: 7 researches (minimum PhD), 8 PhD students, 3 MSc students, 3 technicians
- **Research topics**: Ceramic (nano-)Composites:

Defense	Armors
Engineering	Machining (cutting inserts)
	Low friction material
Energy	Lighting (phosphors)
Electronics	Materials for substrates (high thermal conductivity)
Metallurgy	New types of refractories
Medicine	Bio-materials

- **Researchers expertises**: relationship between microstructure and properties of advanced oxide and non-oxide ceramics



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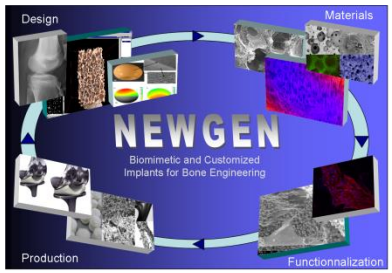
ROLE OF IIC SAS IN NEWGEN

Development of porous Si_3N_4 with controlled porosity

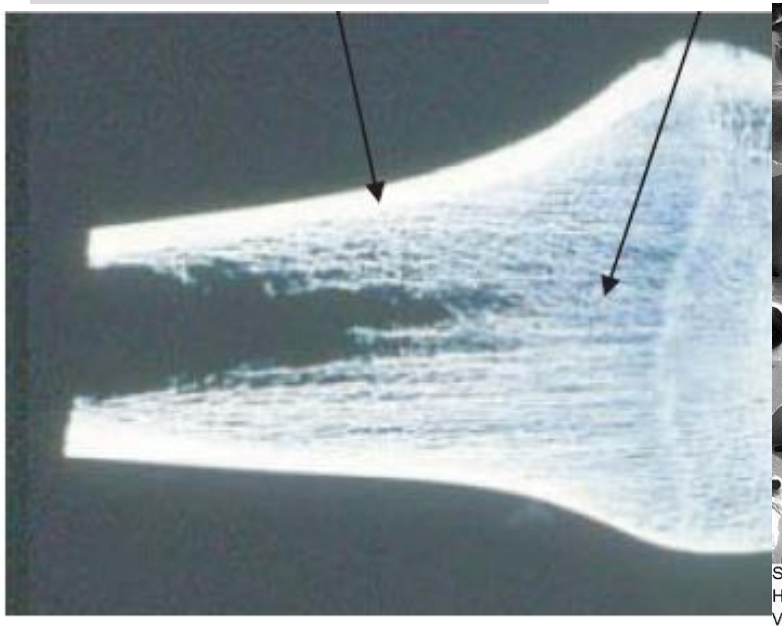
by using foam replica method

Structure (pore size distribution)
Mechanical properties (Young's modulus, strength)
Biocompatibility (inertness and toxicity)

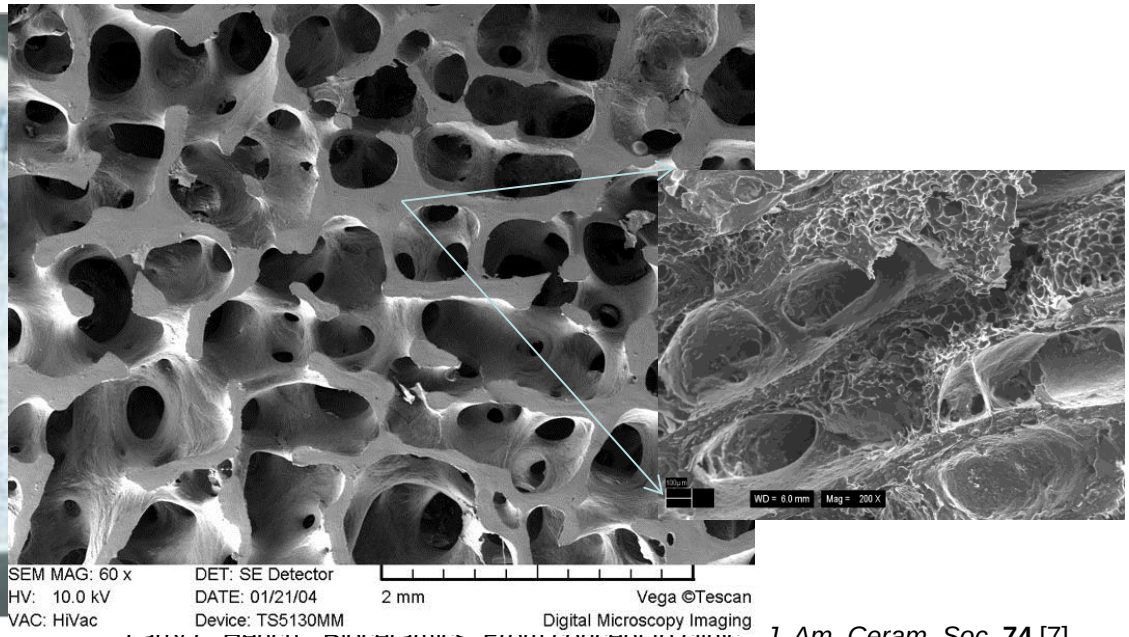


BONE STRUCTURE AND PROPERTIES

Cortical (compact) bone



Cancellous (spongy or trabecular) bone



Larry L. Hench: „Bioceramics: From concept to clinic", *J. Am. Ceram. Soc.* **74** [7]

	Young´s modulus [GPa]	Stear modulus [GPa]	Compressive strength [MPa]	Tensile Strength [MPa]	Shear strength [MPa]	Density [g.cm^{-3}]
Cortical bone	4 - 27	2 - 9	30 - 360	45 - 175	30 - 70	1,8 - 2,2
Trabecular bone	1 - 11	-	7- 190	-	-	1,5 - 1,9

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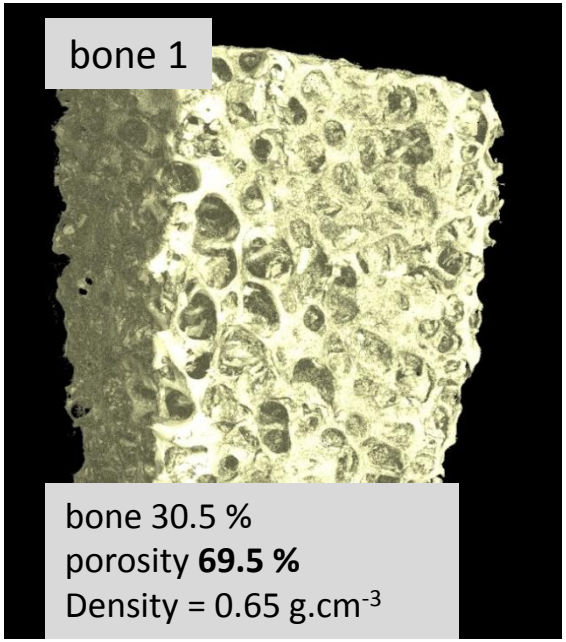
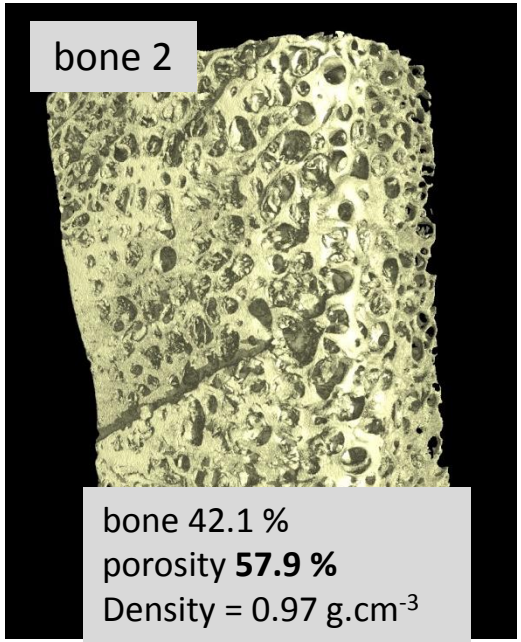
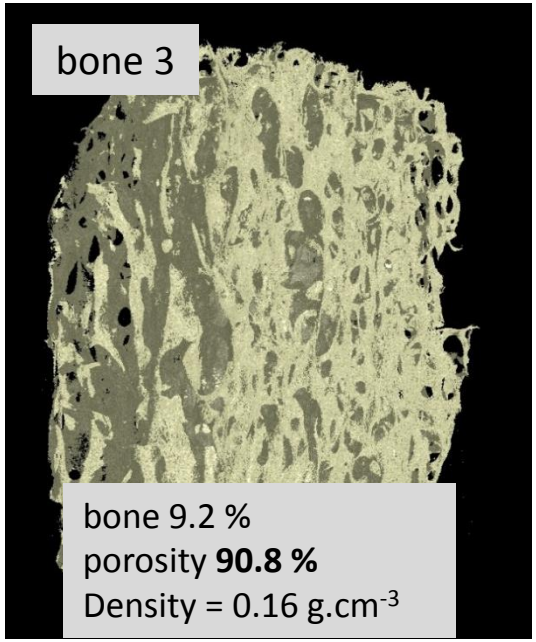
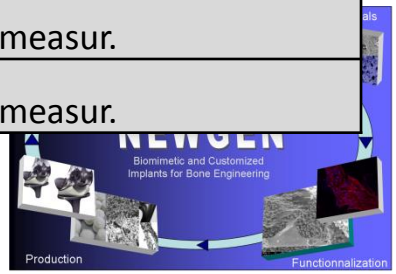
TRABECULAR HUMAN BONE 3D STRUCTURE







	longitudal section			transversal section		
	length (mm)	SD (mm)		**length (mm)**	SD (mm)	
bone 1	**0,82**	0,22	100 measurrements	**0,83**	0,27	100 measur.
bone 2	**0,25**	0,07	250 measur.	**0,42**	0,15	100 measur.
bone 3	**0,94**	0,07	90 measur.	**0,76**	0,23	110 measur.



United tissue Bank
Trieda SNP 1, 040 11 Košice
Sylvia Gromošová

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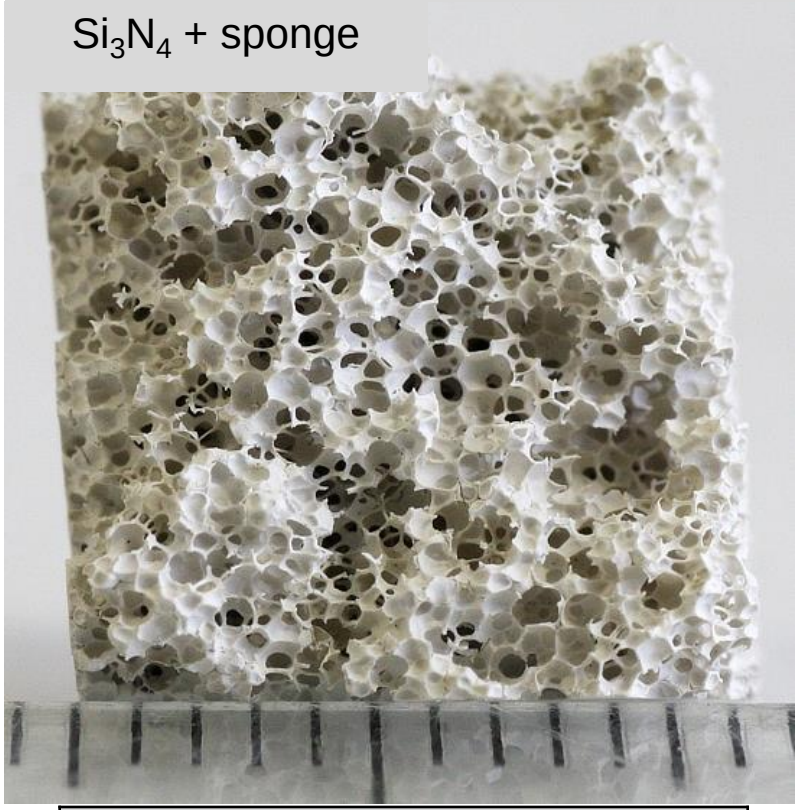
CERAMIC MATERIALS

ASSN

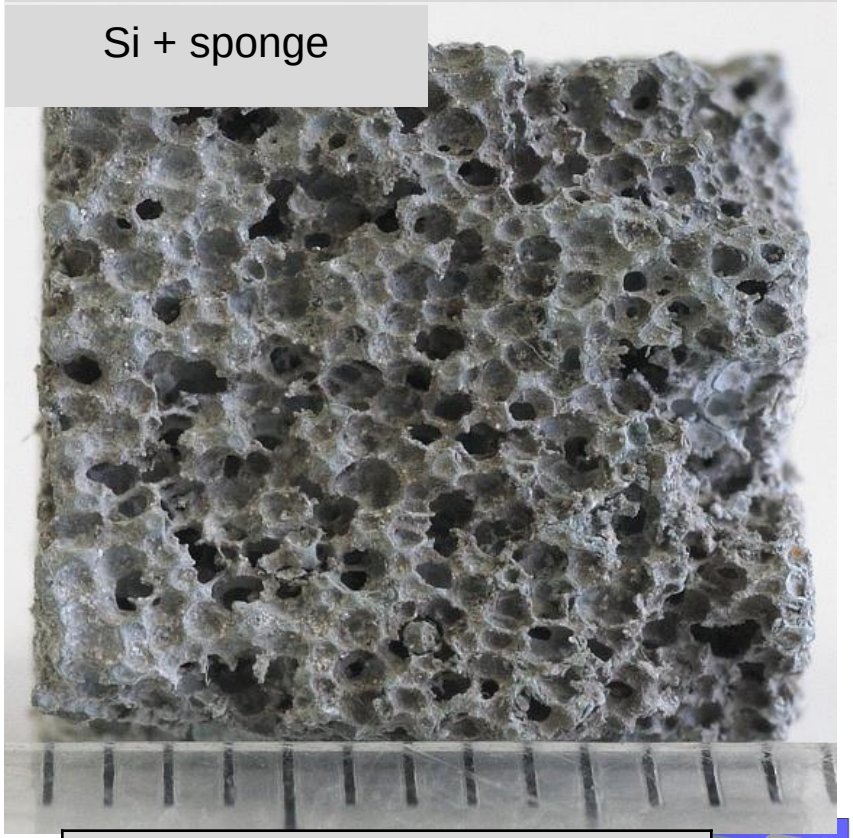
Si_3N_4 + sponge



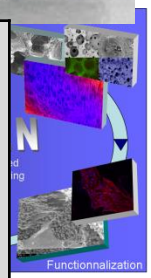
Density [g.cm^{-3}]	
sample 1	0,98
sample 2	1,25
sample 3	1,47

SRBSN

Si + sponge



Density [g.cm^{-3}]	
RBSN 1	0,92
RBSN 2	1,14
RBSN 3	1,52



BIOCOMPATIBILITY AND PROPERTIES

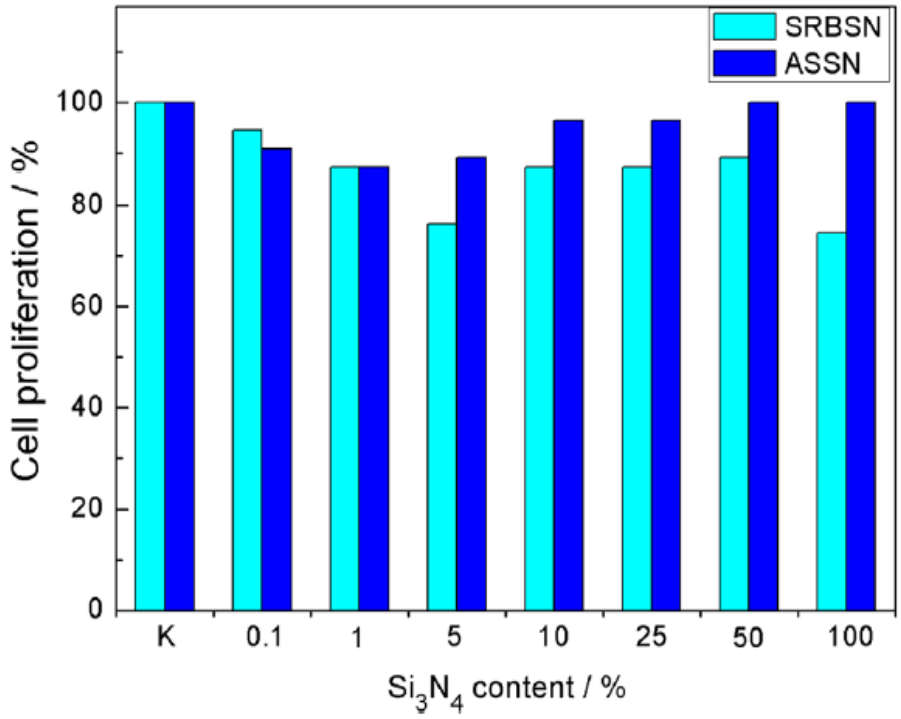
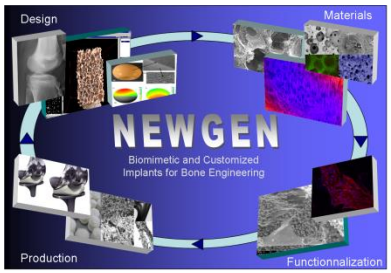


Fig. 5. MTT test of sintered reaction bonded silicon nitride and air-sintered silicon nitride tested at various concentrations of the samples. The cell survival results are expressed as percentage of cells in control medium (K), without the addition of Si_3N_4.

Table 5
Mechanical properties of bone and ceramic samples.

	Bone	ASSN	SRBSN
Hardness (GPa)	0.51 ± 0.03	0.46 ± 0.07	6.3 ± 2.3
Young's modulus (GPa)	11.2 ± 0.9	11.4 ± 0.9	92.1 ± 21.3
Compressive strength (MPa)	4.1 ± 1.9	2.9 ± 0.4	7.5 ± 1.5

K. Bodisova et al., *Ceram International* **39** (2013) 8355-62.



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FACILITIES

Raw materials synthesis: HA synthesis, coating

Ceramic materials processing:



glowbox
homogenization, viscosity measurements
stabilization of the suspensions
foam replica method
sintering (free sintering,HP, GPS, HIP)

Ceramic materials characterization:

sample cutting, polishing, etching,
SEM, TEM, FTIR, XPS, XRD, XPS,
S, C, O, N, H analysis, porosimetry
strength, (nano-)hardness, fracture
toughness, Young´s modulus
biocompatibility (inertness and toxicity)