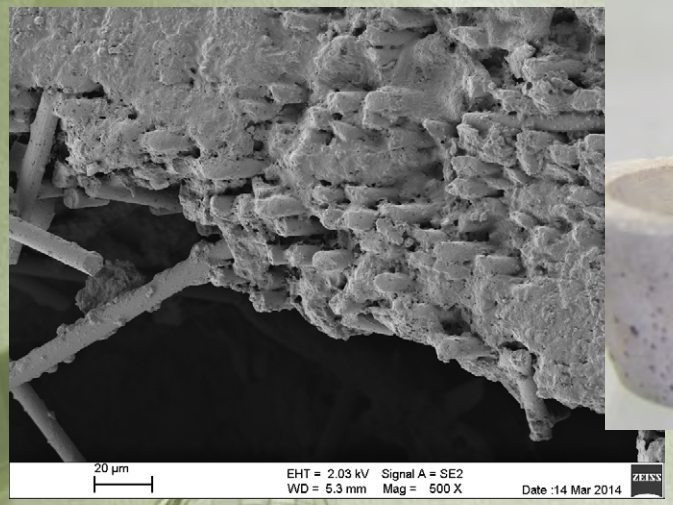
TECHNICAL UNIVERSITY OF LIBEREC

Institute for Nanomaterials, Advanced Technologies and Innovation



Karolína Borůvková
Iva Dufková

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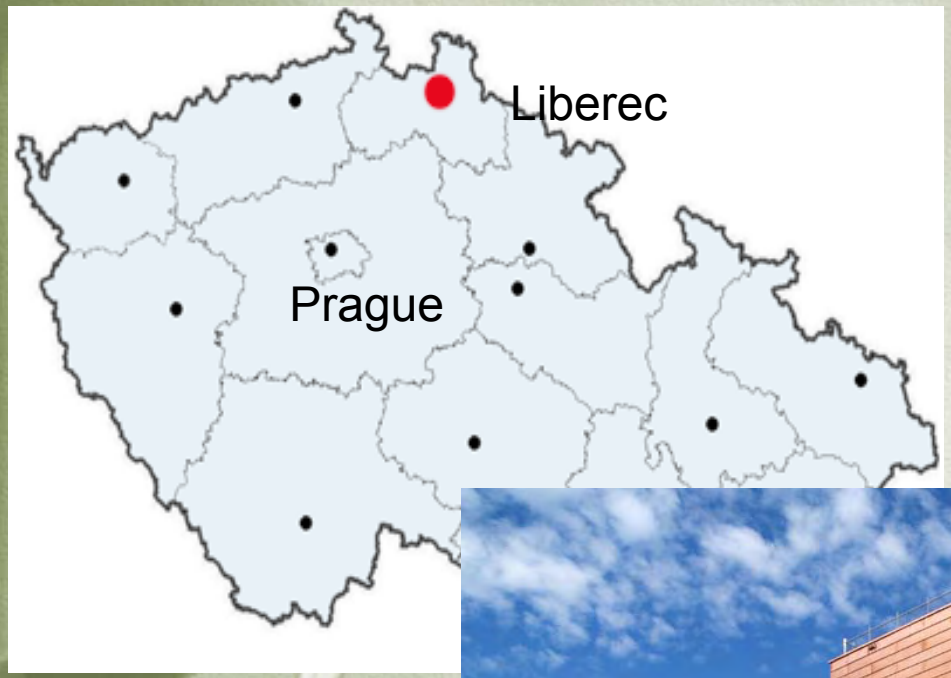


TECHNICAL UNIVERSITY OF LIBEREC

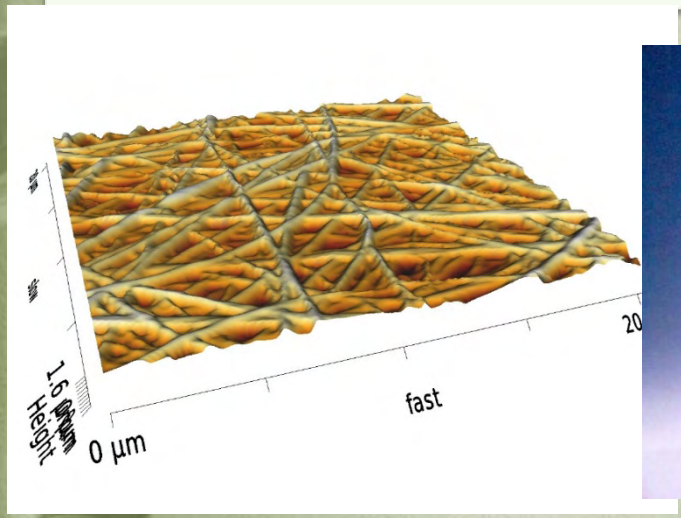
Institute for Nanomaterials, Advanced Technologies and Innovation

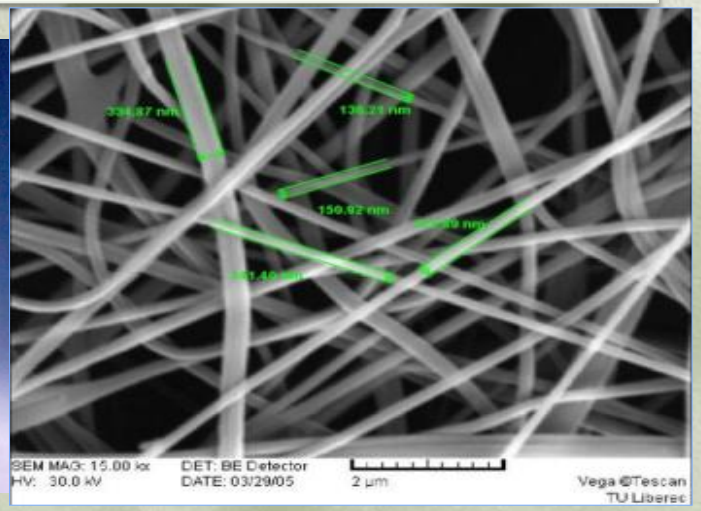
150 researchers from 10 countries

35M € investment from EU, Turnover in 2014 = 8M €

(Sustainability of Project – min 10% = 3,5M€/year)

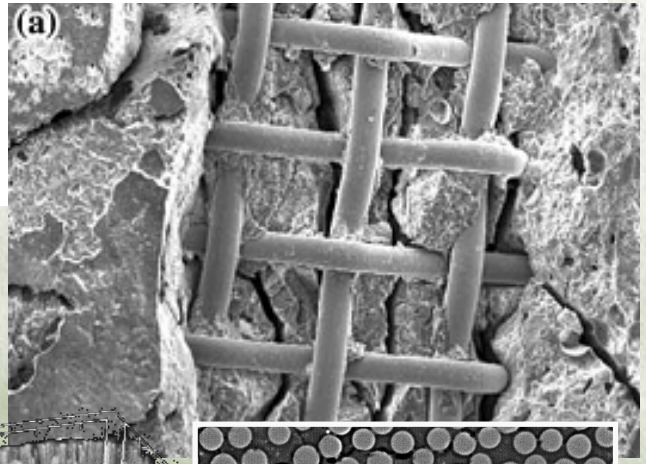
- Final application oriented research
- Direct cooperation with industrial partners
- International approach (researchers, cooperations)
- Wide range of the research fields (nanomaterials, automotive, medical, filtration, advanced machinery)

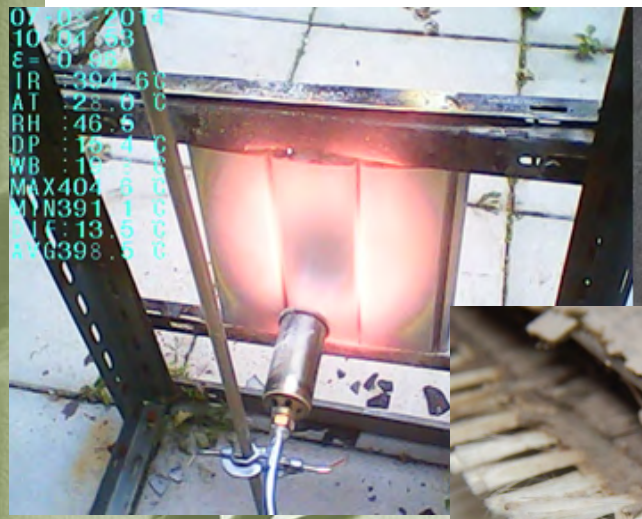


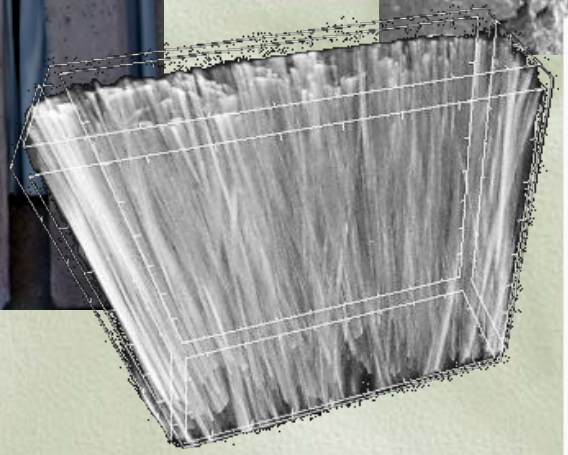


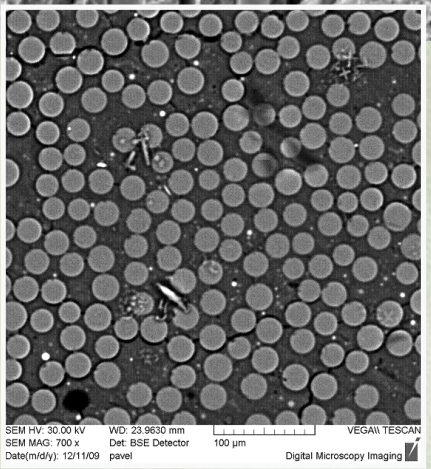
Laboratory of geopolymers

- Geopolymer-based composites with fibers and nanoparticulate reinforcement
- Heat resistant geopolymer mortar
- Surface modifications









Hydrophobic treatment

- Basic component of impregnating liquid is the methyl-silicon resin. By using a suitable solvent (e.g. xylene) and water is formed an aqueous emulsion. Thus prepared emulsion should be further thickened to increase the viscosity of the resulting solution.

- The silicone component is via a carrier solvent of water and residual solvent highly efficiently transported deep into the structure of the material .

- To increase the utility properties (hydrophobic and antisoiling) of the emulsion are part of the emulsion also nanoparticles.

- The protective layer is developed on the basis of nanotechnology. Thanks to the nanometric dimensions (10 - 30nm) nanoparticles can penetrate into the porous structure of the substrate.

Hydrophobic treatment

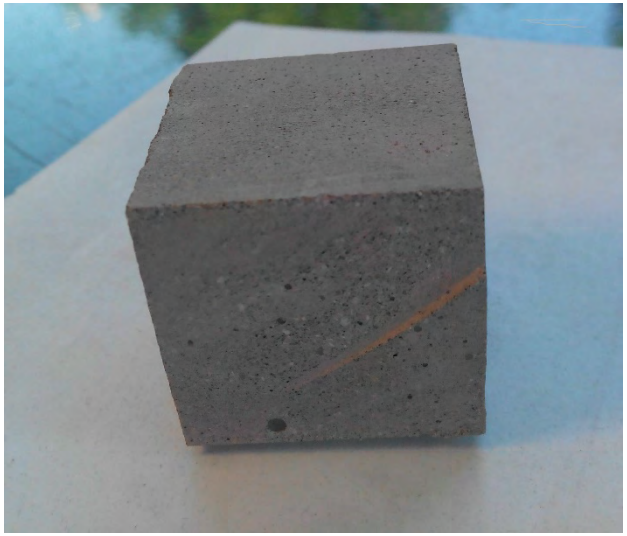
Tested substrate: **BAUCIS L 160 (České lupkové závody, a.s)**

- geopolymeric binder based on fire clays
- light gray in color
- alkalination with sodium solution

Composition: Metakaolinite

Al_2O_3	41 - 43 %
Fe_2O_3	3 %
TiO_2	1,6 %
K_2O	0,6 %
CaO (MgO)	0,2%
SiO_2	52 - 53%

+ 20 % CaO

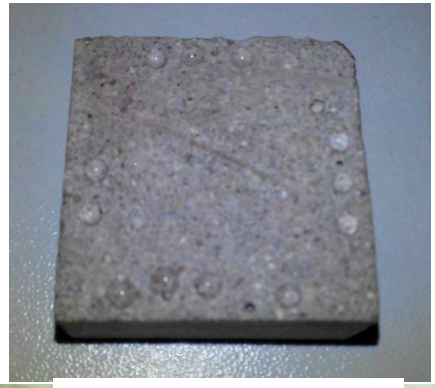


Hydrophobic treatment

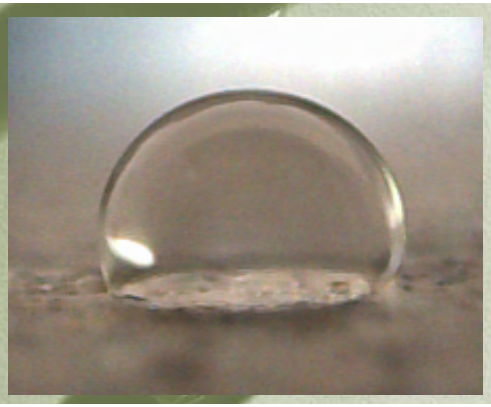
Contact Angle Measurements

Tab. 1: The average value of the contact angle (of 10 measurements)

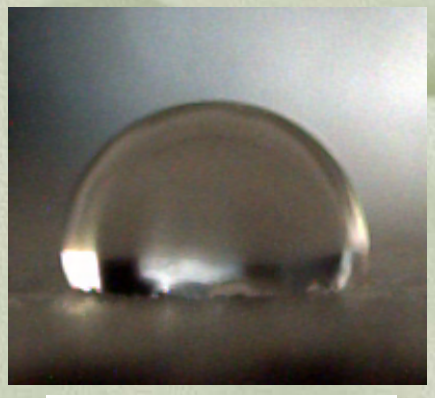
Sample	**[θ]**
Untreated	47,64
Pure emulsion	103,18
Emulsion with nanoparticles	105,39



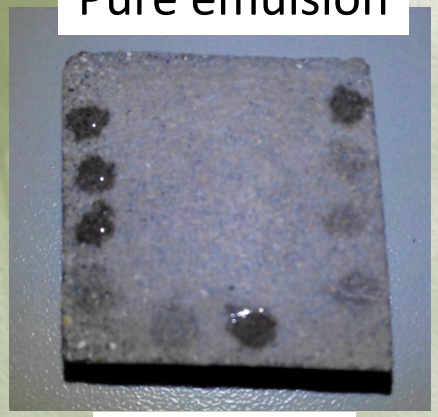
Pure emulsion



Emulsion with nanoparticles



Pure emulsion



Untreated

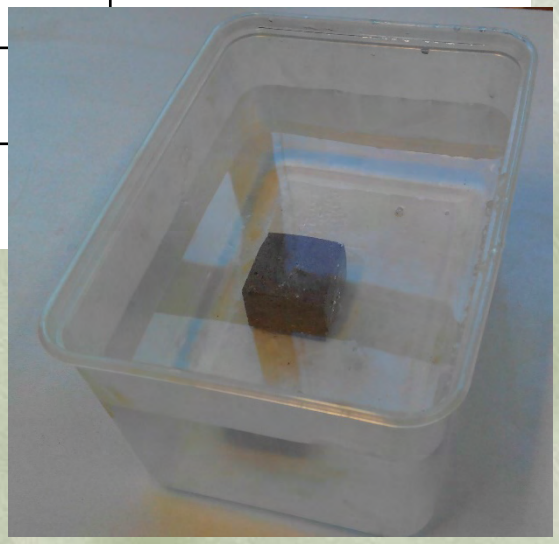
Hydrophobic treatment

Measurement of water absorption

Samples weighing 15 g were immersed in 500 ml of water for 48 hours.

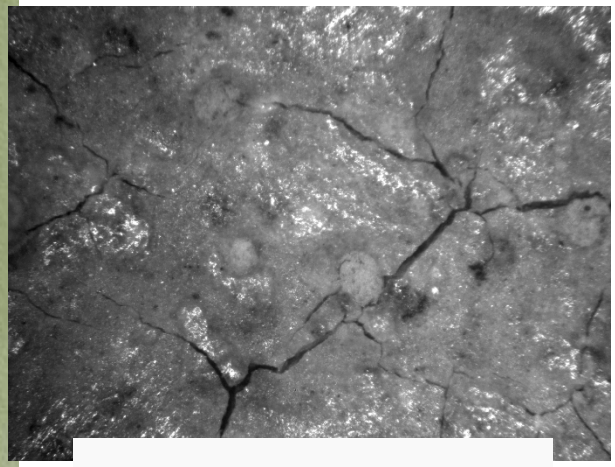
Tab. 2: The average value of water absorption (of 3 measurements)

Sample	**Absorption [%]**
Untreated	76,05
Pure emulsion	17,71
Emulsion with nanoparticles	17,03

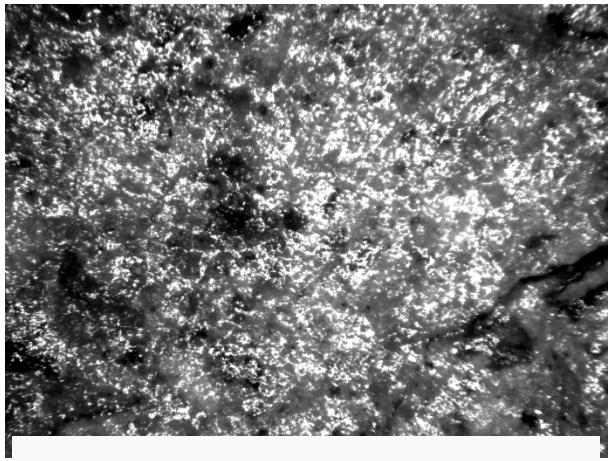


Hydrophobic treatment

The behavior of samples under the elevated temperatures (LOM) – magnification 40x

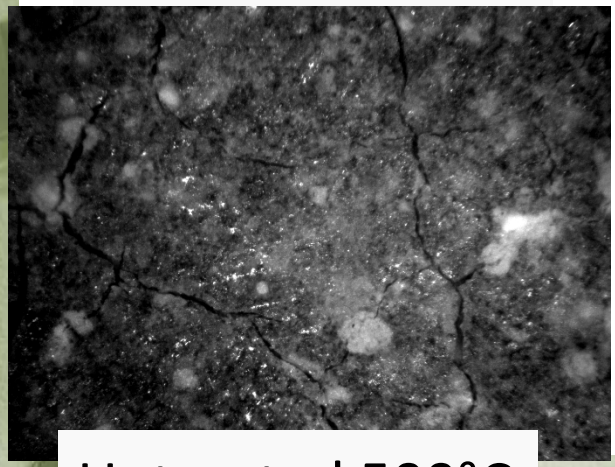


Untreated 200°C

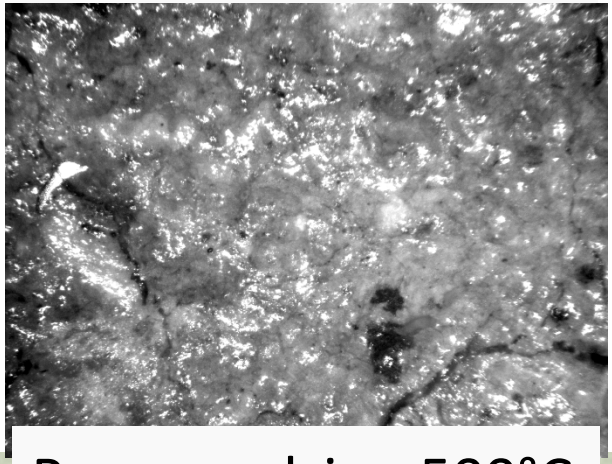


Pure emulsion 200°C

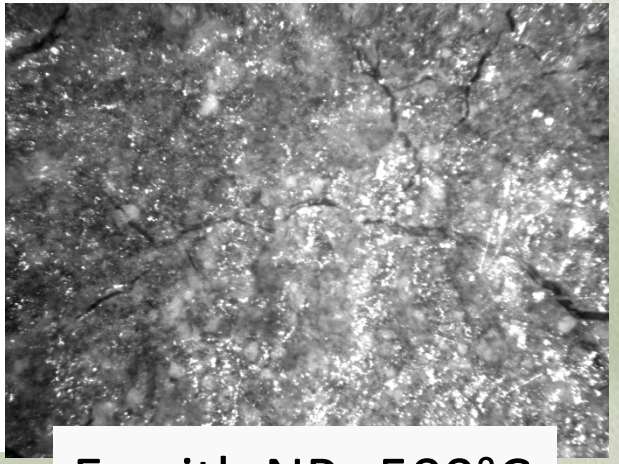
E. with NPs 200°C



Untreated 500°C



Pure emulsion 500°C

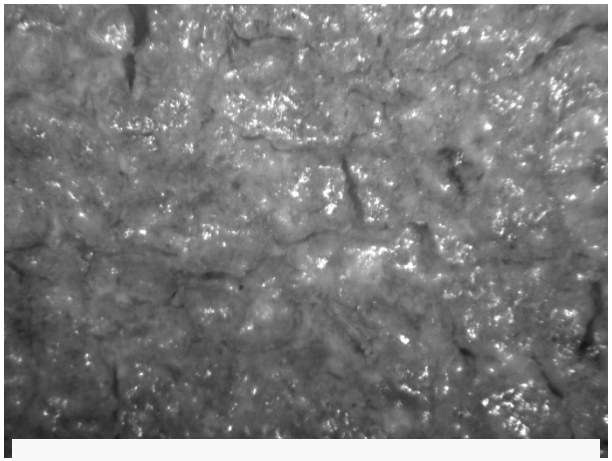


E. with NPs 500°C

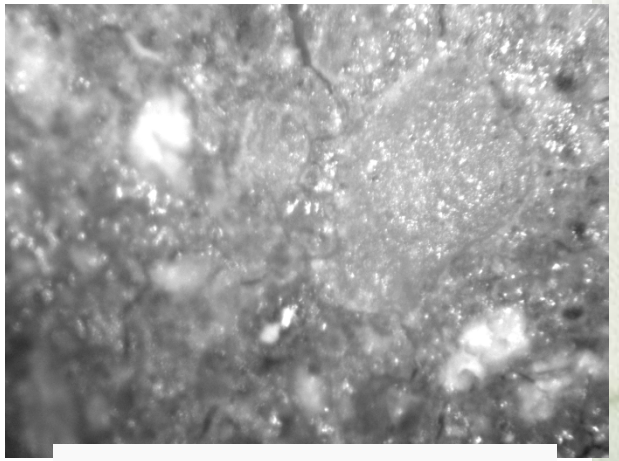
Hydrophobic treatment

The behavior of samples under the elevated temperatures (LOM) – magnification 40x

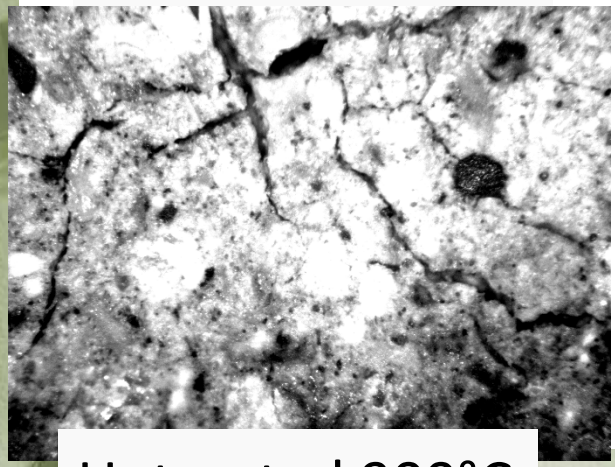
Untreated 700°C



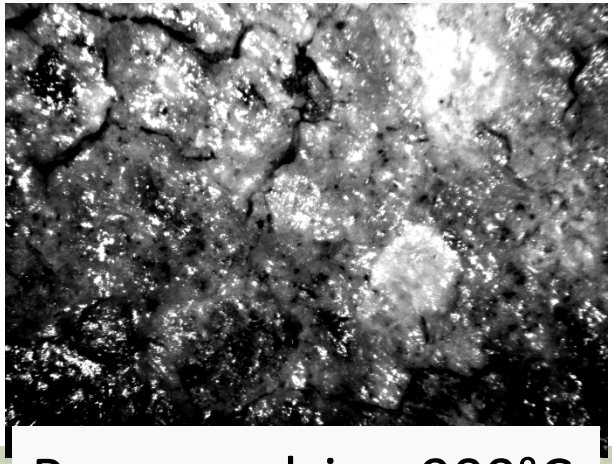
Pure emulsion 700°C



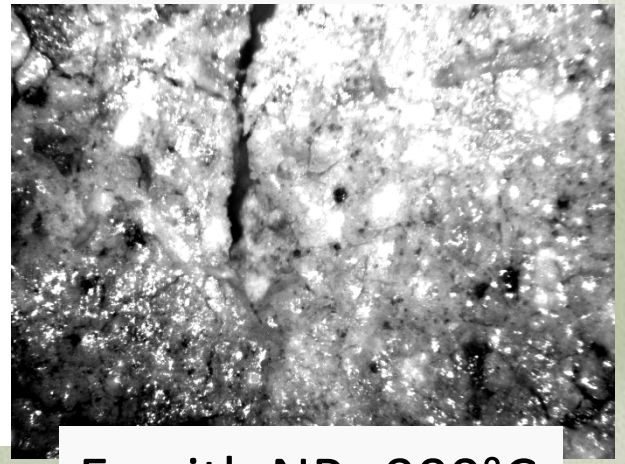
E. with NPs 700°C



Untreated 900°C



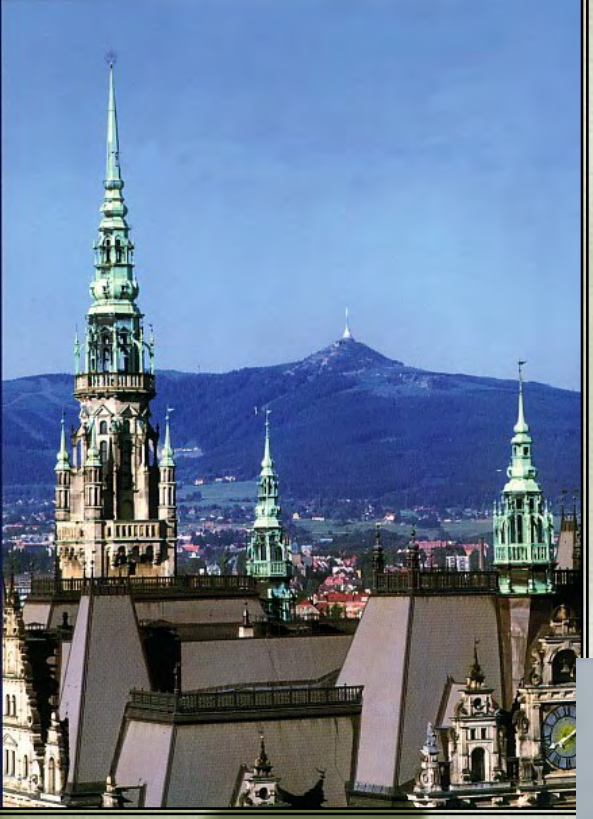
Pure emulsion 900°C



E. with NPs 900°C

Hydrophobic treatment

Using this impregnation may also prevent efflorescence.



Thanks for Your Attention

contact: karolina.boruvkova@tul.cz; iva.dufkova@tul.cz