

# Investigation of the stability and solubility of suspensions of nano-ZnO and nano-ZnO:Co received at the Laboratory of Nanostructures for Photonic and Nanomedicine CePT

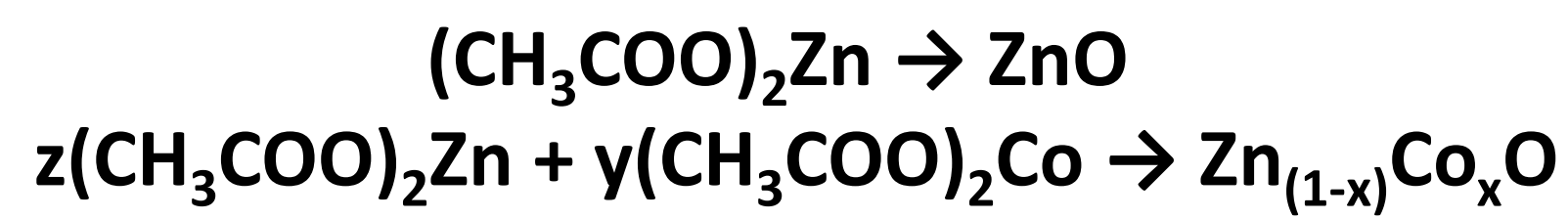
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## Solvothermal synthesis of nano zinc oxide

Nanoparticles of zinc oxide are obtained through microwave technology MSS (Microwave Solvothermal Synthesis). The MSS technology enables to prevent contamination of synthesis, by sealing the reaction vessel made of a chemical inert material, so that we obtain ultra-pure product.

Innovation of MSS technology is the possibility to control a size of the crystallite of nanoparticles in a narrow size distribution. ZnO-NPS, ZnO:Co-NPS are synthesized in the reaction, which can be expressed as follows:



We are able to synthesize nanoparticles of ZnO and ZnO:Co with controlled properties such as size, shape, surface, thanks to the unique in a global scale microwave reactor to solvothermal synthesis. Additionally there is the effect of the mixing in a microwave reactor, so that the obtained product is homogeneous.



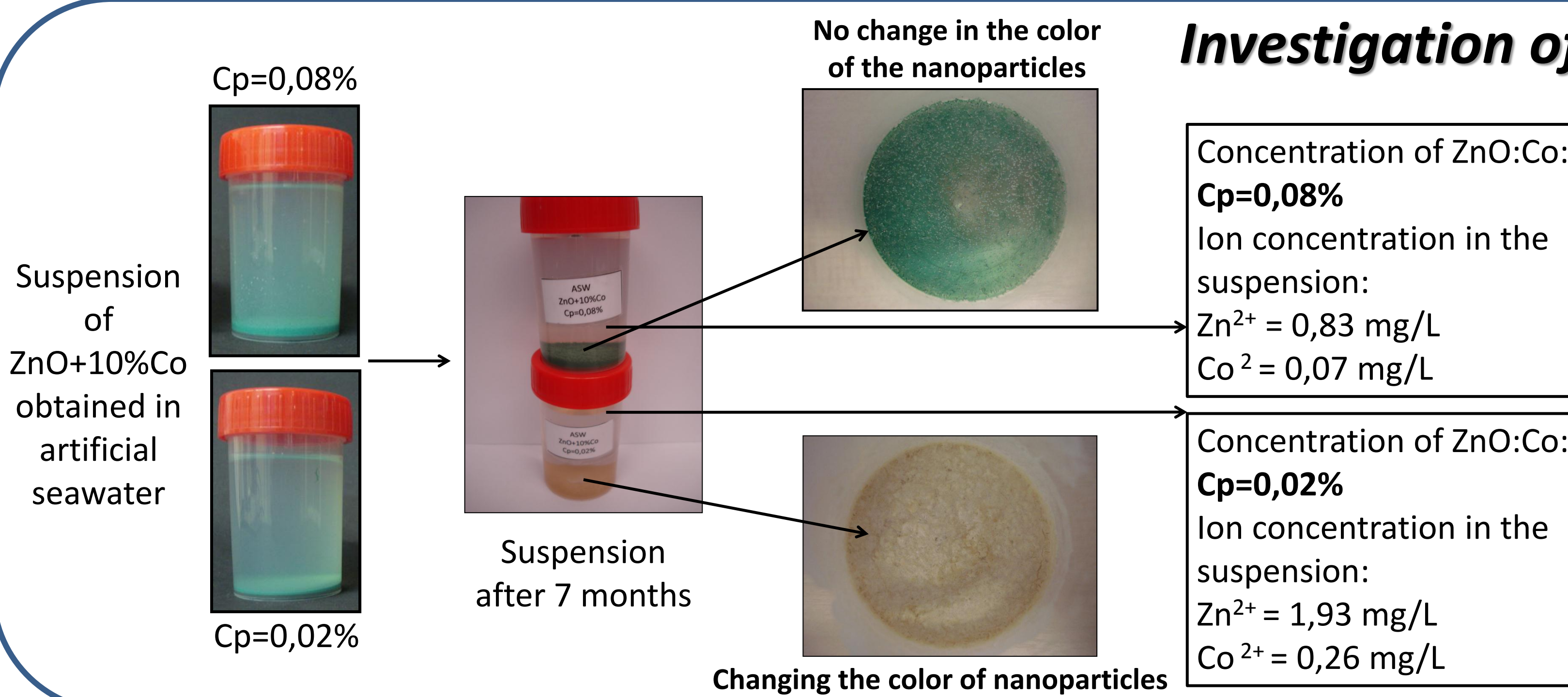
Microwave reactor  
ERTEC model Magnum II.

- 2,45 GHz, 600 W
- nominal working pressure 50 bar
- maximum working pressure 100 bar
- material of chamber PTFE
- temperature up to 300°C
- capacity 108 cm<sup>3</sup>
- time of synthesis of ZnO is 25 minutes



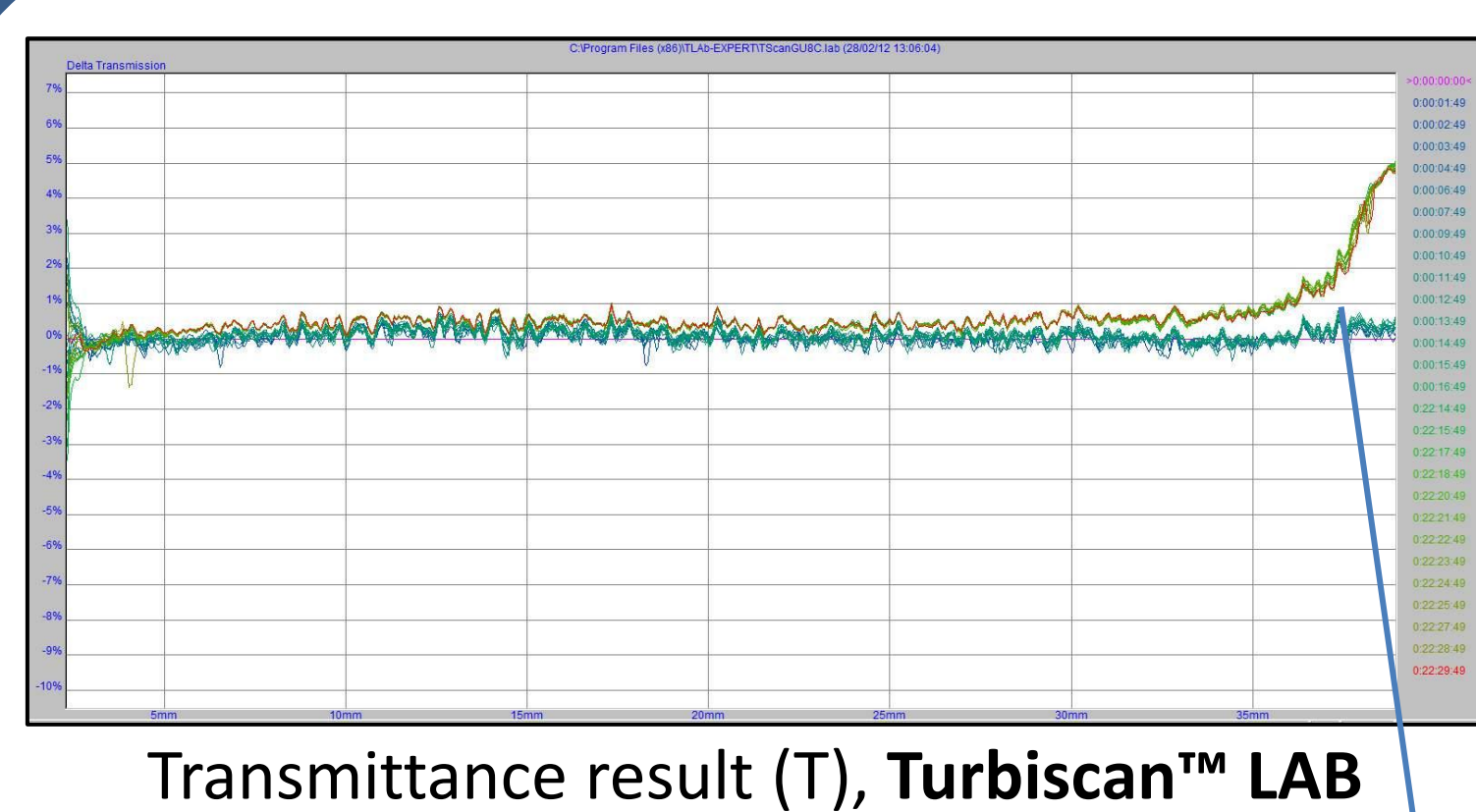
Microwave reactor  
IWC PAN, ERTEC, ITE-PIB  
model MSS-2

- reactor type stop-flow
- 2,45 GHz, 3 kW
- maximum working pressure 100 bar
- materials of chamber PTFE, Al<sub>2</sub>O<sub>3</sub>
- temperature up to 260 °C
- capacity 470 cm<sup>3</sup>
- time of synthesis of ZnO is 15 minutes
- substrates batcher

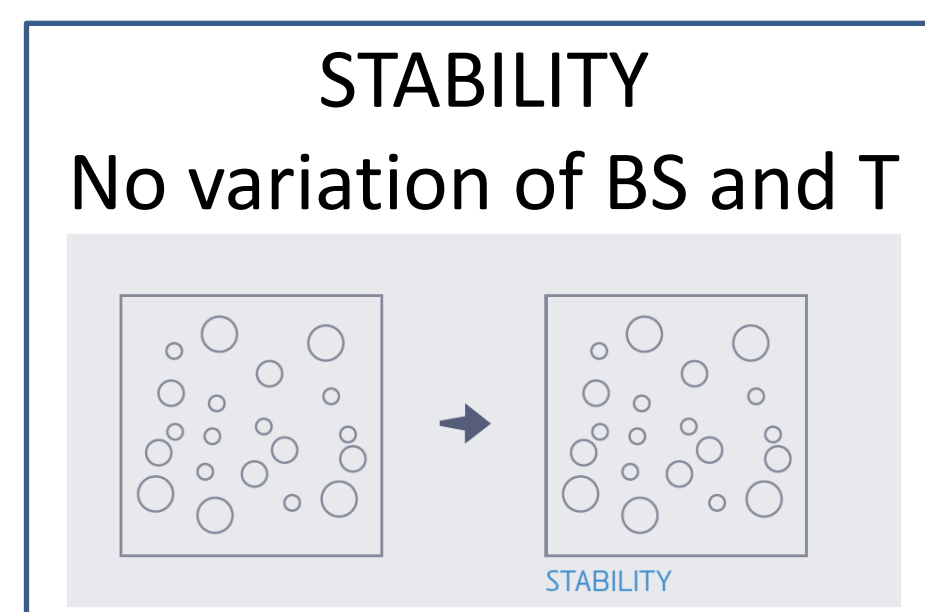
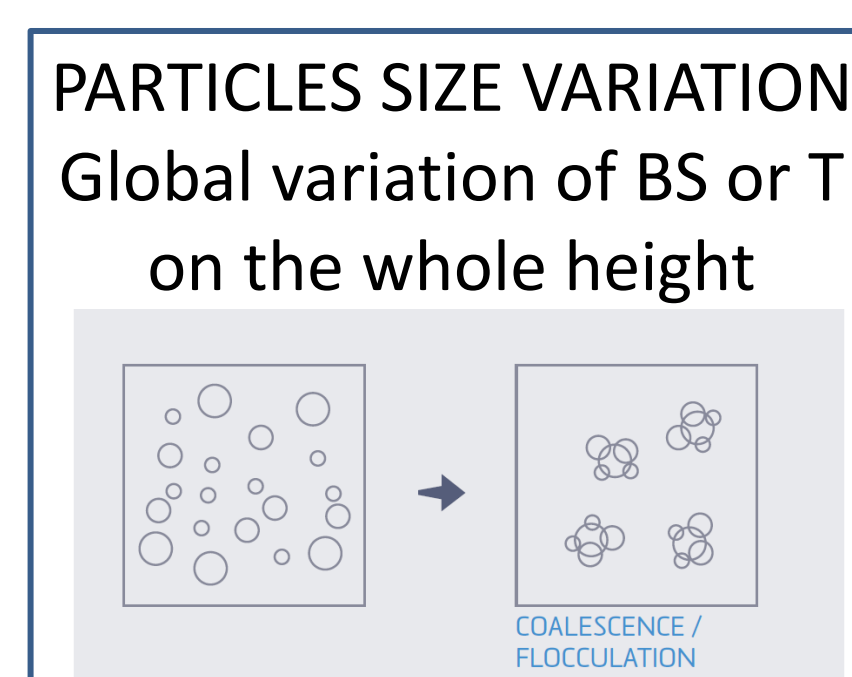
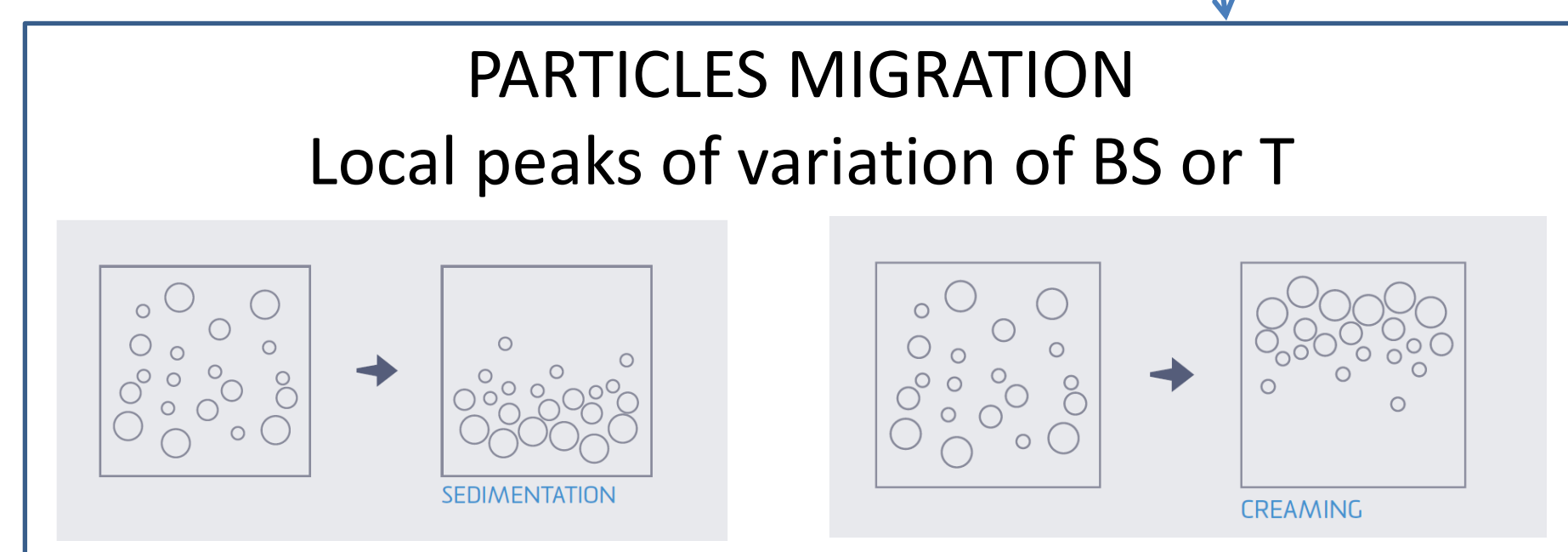


Spectrophotometer  
DR 3900 Hach Lange

**DR 3900 Spectrophotometer Hach Lange** was purchased for CePT project. Concentration of zinc ions and cobalt ions were analyzed by colorimetric analysis. Spectrophotometer DR 3900 was used to measure ions concentrations. Zinc method (0.01 to 3.00 mg /L), number 8009, was used for the determination of zinc ions (Zn<sup>2+</sup>). PAN 1- (2-Pyridylazo)-2-naphthol number 8078 method was used for the determination of cobalt ions (Co<sup>2+</sup>).



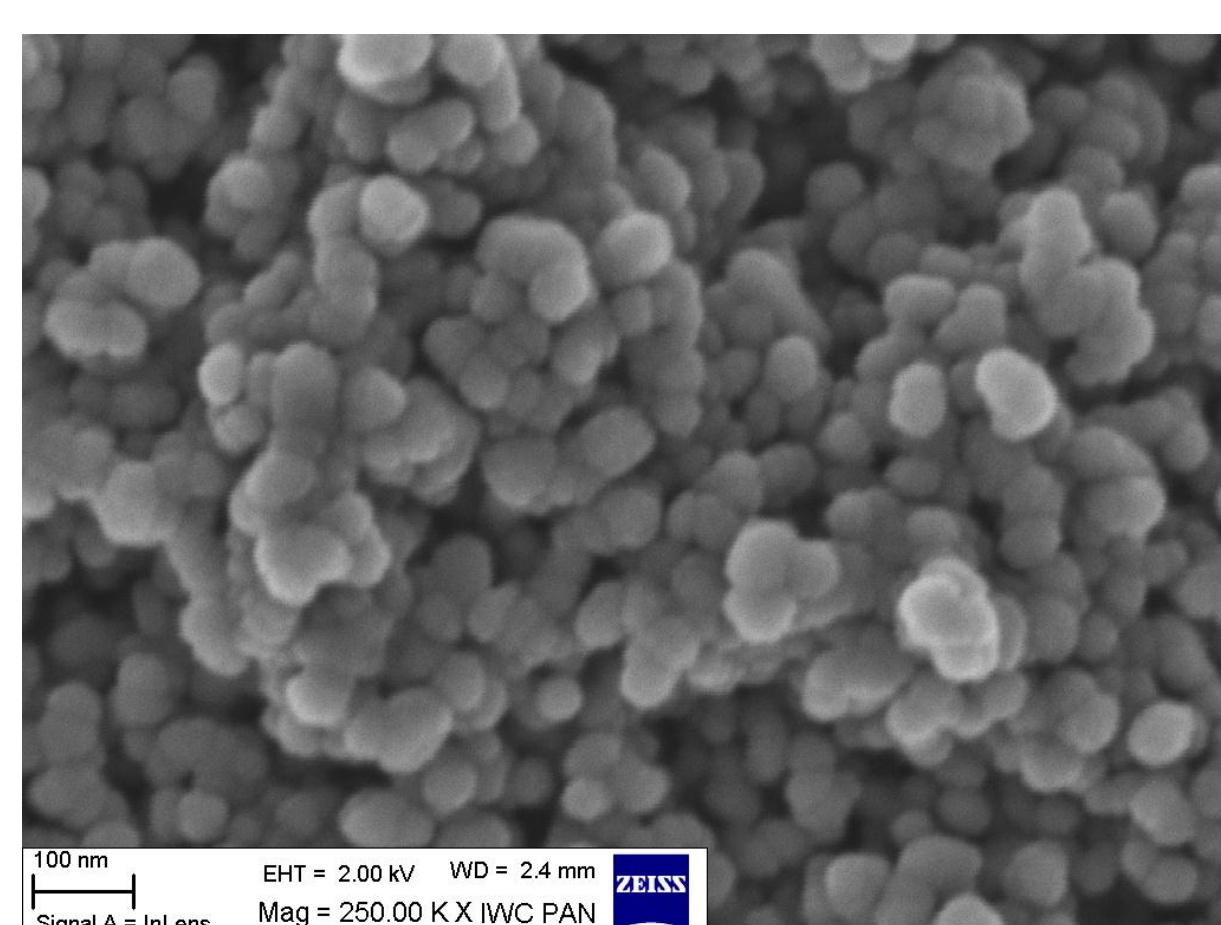
## Investigation of the stability of suspensions



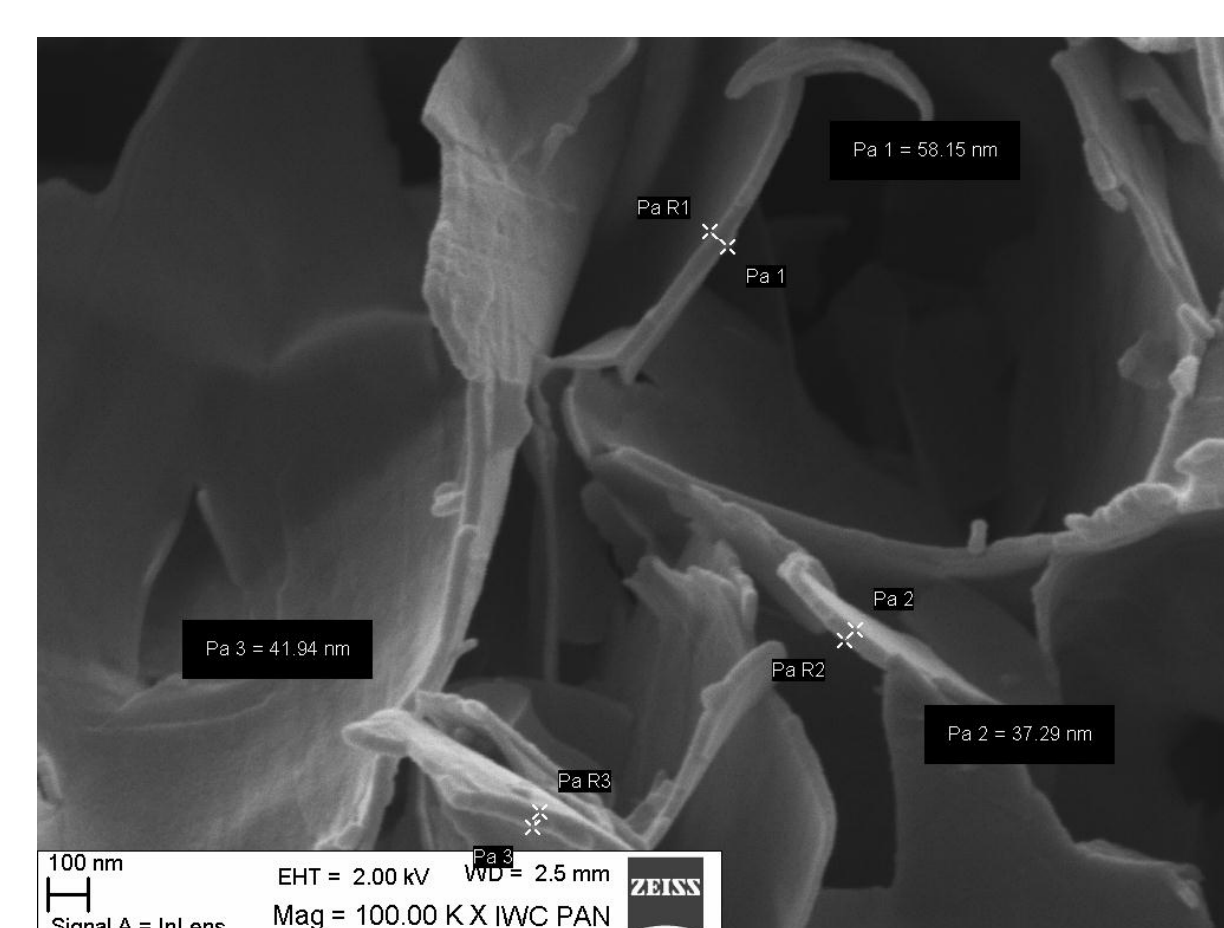
Turbiscan™ LAB, Stability Analyser

**Turbiscan™ LAB** was purchased for CePT project. Analyzer DWS (Diffusing-wave spectroscopy) is used in order to characterize the dispersion state of emulsion, suspension and foams. The obtained results present homogeneity, concentration of particles and average diameter of the particles in test sample. It allows the calculation of the physical parameters of these systems, so it is very helpful in optimizing processes. User can study all kinds of liquid dispersions with concentration up to 95% v/v, over a wide range of size (10 nm to 1 mm)

## Investigation of stability of nanoparticles – environmental transformation



SEM micrograph of ZnO+10%Co  
nanopowders

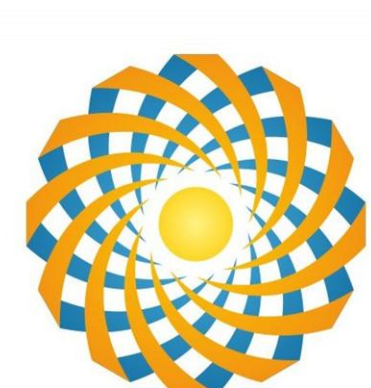


SEM micrograph of ZnO+10%Co  
nanopowders after environmental  
transformation



Zeiss, Supra Gemini

The pictures were made with a ZEISS scanning electron microscope. Zeiss Supra scanning electron microscope with column Gemini is a unique high-resolution low-voltage device designed to study the surface morphology of solids in micro- and nanoscale. Due to the geometry of the LEO 1530 chamber it is possible to run analytical instruments like EDS, WDS and EBSD parallelly without restrictions in high vacuum.



Laboratorium  
Nanostruktur  
Instytut Wysokich Ciśnień PAN



INNOWACYJNA  
GOSPODARKA  
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