## Nanostructured surfaces

# Nanocrystaline powder in the $ZrO_2$–$Y_2O_3$–$CeO_2$–$Al_2O_3$-CoO system as basis for bioinert ceramics

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Zirconia is one of the most promising bioinert materials owing to the best mechanical properties among oxide ceramics. Bioinert zirconia ceramics are widely used for orthopedic joint replacements but it is prone to aging in the presence of water. This has been unfortunately verified in vivo with some critical consequences. The degradation is caused by the tetragonal→monoclinic (t→m) transformation of $ZrO_2$ and the main purpose of researches is to produce composite based on the zirconia tetragonal solid solution, which is stable to aging.

A scientifically sound approach to each stage of producing $ZrO_2$-based bioinert implants (from the synthesis of starting powders to their sintering) is a necessary condition for promoting the optimum structure and high mechanical properties. Materials produced from nanocrystalline powders exhibit increased resistance to low temperature aging processes in the environment of the living organism.

The aim of this research was to investigate properties of composites produced from nanocrystalline powders of compositions (wt.%) (90{$ZrO_2$-$Y_2O_3$-$CeO_2$}-10$Al_2O_3$)-0,5$Al_2O_3$-0,5CoO after hydrothermal degradation.

Zirconia-based samples were subjected to hydrothermal degradation via in vitro exposure to water steam at 140 °C for 7 h. X-ray diffraction and scanning electron microscopy techniques were applied to observe t→m phase transformation of $ZrO_2$ before and after hydrothermal degradation.

The XRD results revealed that after hydrothermal degradation the formation of monoclinic $ZrO_2$ was not identified. Since the results are satisfactory these composite need further and more detailed investigation. The research results serve as a scientific basis for microstructural design of various bioinert implants in the $ZrO_2$–$Y_2O_3$–$CeO_2$–$Al_2O_3$-CoO system.