## Nanocomposites and nanomaterials

# Cu, Ag - Functionalized nanomaterials based on zirconia: structure and properties

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Cu,Ag-functionalized nanosized systems based on zirconia are promise materials for optics, electronics and medicine. The feature of these systems is special state of Cu or Ag as oxide or metal clusters in bulk or/and on surface of zirconia. In this work the set of $CuO,Ag_2O$-functionalized zirconia nanoparticles was synthesized by co-precipitation method. The oxide nanoparticles were forming as result of two stages: MW drying of hydrogel and its transfer to amorphous xerogel and convectional heat-treatment of amorphous xerogel and its transfer to zirconia crystal. The structure, surface state and kinetic of formation of amorphous and crystal nanoparticles was investigated by DSC, IR, ESR- spectroscopy and XRD and SEM methods. It was shown that structures of initial Cu (Ag)-contained complexes that were formed in precipitation process determine kinetic of drying, dehydration, and crystallization of investigated systems and also growth of oxide nanoparticles. Noted that the CuO addition in zirconia led to destabilize tetragonal zirconia system at heating above 800°C, such as $Ag_2O$ addition in zirconia didn't influence stability of tetragonal phase. Interconnection between phase stability and structure of CuO-contained clusters on zirconia surface was found. The mechanism of change of functionalized zirconia surface state and structure under temperature treatment in 400-1000°C is discussed.

The system Cu,Ag-functionalized zirconia nanoparticles was synthesized by reduction of amorphous and oxide $CuO,Ag_2O$-functionalized zirconia nanoparticles of different sizes by glucose. It was shown that the morphology of initial $CuO,Ag_2O$-functionalized zirconia nanoparticles determines type of nanocomposite structure – zirconia core/metal cluster shell or metal cluster in zirconia matrix. The work carried out in framework of 6.22.7.33 project of government program of "Nanotechnology and nanomaterials" on 2010-2014 years.