

PP06

Sol-Gel Materials Doped with Transition Element Ions and Nanoparticles**A.A.Boiko, E.N.Poddenezhny**** Gomel State Technical University, 48, October av., 246746, Gomel, BELARUS.**E-mail: boiko@gsu.gomel.by***ABSTRACT**

The systematic investigation of colloidal-chemical properties and formation regularity of broad scope of silica-containing ultra-dispersed systems, which are a basis for sol-gel synthesis of new functional materials in volumetric forms was carried.

The physical-chemical principles of synthesis process of silica-containing functional materials using features of structural-phase transitions "sol – gel – solid" at the introduction in to colloidal systems the active fillers (aerosils), doping components, gel-forming products have been worked out.

The glasses doped with transition element ions and composites were prepared by hybrid sol-gel process[1], modified in the part of doping technique. The flowchart of the hybrid sol-gel process incorporates the following stages: tetraethoxysilane (TEOS) hydrolysis in the system $\text{Si}(\text{OC}_2\text{H}_5)_4$ - $\text{C}_2\text{H}_5\text{OH}$ - H_2O - HCl with mole ratio 1:2:16:0.01 by vigorous mixing in fluoroplastic reactor in air; addition the fumed silica with a specific surface $300\text{cm}^2/\text{g}$ (aerosil T30, Wacker – Chemie GmbH, Germany) into the sol as filler, ultrasonic dispergation and centrifugal separation from agglomerates and dust particles. Then, the sol was neutralized up to $\text{pH}=6.5$ with the help of ammonia solution and cast into fluoroplastic moulds to prepare the solid gels shaped as disks. The wet gels were formed during 20-30 min in sealed containers; then the containers were opened and the gels were washed by bidistilled water.

The resulting gels were dried slowly at $30\text{-}60^\circ\text{C}$ in the period 7-14 days in air and presintered at 600°C in 2 hours. After heat-treatment the xerogels were impregnated by water or organic solutions of salts, containing transition element ions.

Using of Cr-containing aqueous solutions for xerogels impregnation results in the preparation of hydroxylated silica xerogels, doped with Cr^{3+} , and the following thermo-treatment of Cr-containing porous materials at the temperature 1200°C on air lead to formation of colored silica glass. The using aerosils, modified by nanoparticles of $\alpha\text{-Cr}_2\text{O}_3$ results in the preparation of nanocomposites [2].

The correlation between structure, chemical, phase composition and properties of functional materials – gel-glasses and monolithic composites has been developed experimentally.

The rheological and physical-chemical parameters of colloidal-silicate systems, containing the transition element ions were determined. The influence of thermo-treatment of xerogels on structure and pore morphology have been investigated.

The colored, UV-filtering glass like materials, activated with Cr^{3+} , Co^{2+} , Fe^{3+} , Cu^+ and nanocomposite $\text{SiO}_2:\text{Cu}^0$ were created.

References

- [1] E.N.Poddenezhny, A.A.Boiko. Sol-gel synthesis of optical silica glass/ Gomel, "P.O.Sukhoi GSTU". 2002. (rus) – 210p.
- [2] E.N.Poddenezhny, A.A.Boiko, A.A.Alexeenko, N.V.Borisenko, M.V.Bogatyrev Using of modified aerosils in the sol-gel synthesis of doped glass like materials // Fiz. i Chim. Stekla (rus) – 2003. – Vol.29, N5. – P. 654-661.