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KINETICS AND TOPOCHEMISTRY OF OLIGOPEROXIDE-BASED SYNTHESIS OF FUNCTIONAL POLYMERIC AND HYBRID COLLOIDS AND NANOPARTICLES FOR BIOMEDICAL APPLICATION

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Oligoperoxide based possibilities of the synthesis of luminescent, magnetic and other functional nanocomposites with controlled size distribution, functionality, reactivity and biocompatibility are presented. Developed methods provide combining the stage of formation of polymeric, metal and metal-oxide nanoparticles with the stage of their surface irreversible modification by functional fragments capable of radical and other reactions including binding physiologically active substances.

The kinetics and topochemistry of low temperature emulsion polymerization in the presence of oligoperoxide metal complexes (OMC) as emulsifier-initiators witness the nucleation mechanism providing strictly monodisperse functional nanoparticle formation. Both experimentally determined and calculated kinetic characteristics of all elementary stages of emulsion polymerization initiated by these substances as well as polymer formed molecular weight dependences on monomer conversion can be explained by the possibility of polar monomer coordination on oligoperoxide metal complexes and controlling the kinetic and thermodynamic parameters of the polymerization. There was established that $k_p/k_o^{0,5}$ values and the amount of radicals per polymer-monomer particle increase dramatically with the enhancement of monomer ability to coordinating with OMC. The equation taking into account this suggestion was proposed and the rate constants of all elementary stages that are in a good agreement with equation were determined.

Hybrid polymer-mineral Cu, Cu_2O, Au, Ag, Ni, and Fe oxide nanoparticles with functional reactive shell were obtained via homogeneous nucleation in the presence of functional; oligoperoxide surfactants as template and surface modifier also. The kinetic equation for calculation of the amount of Cu_2O colloidal particles formed in the presence of oligoperoxide surfactant was proposed:

$$N = \frac{3C_0 \cdot \mu_{Cu_2O}}{\rho a_i^3 \sqrt{2}} \cdot \left(1 - e^{-k\tau}\right)$$

Novel functional colloids and nanoparticles are studied by chemical, colloidal-chemical, and rheological methods, X-ray diffraction technique, luminescent spectroscopy, transmission and scanning electronic microscopy. The availability of ditertiary peroxide fragments on the nanoparticle surface causes their ability to radical grafting of functional polymer chains. Functional nanoparticles developed are studied in phagocytosis, as markers of pathological cells, antimicrobial remedies and nanocarriers for targeted drug delivery.