Nanocomposites and nanomaterials

"Polymer-oxide" micro/nano-composites: background and promises

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A lot of new nanosized materials emerged for last decade both in traditional and advanced technologies, e.g. industry of consumer goods, high-tech aircraft industry, electronics, biomedicine etc. It is obvious there is now a demand for environmental and human friendly materials. Advanced materials based on polymer matrix and incorporated with some nanosized particles provide many advantages. Complex inorganic oxides are considered as important components of polymer composites which are perspective for many practical applications. Opportunities to use such composites are related with peculiarities of micro/nano particles confinement in polymers. As for scientific impact, current and future interest is in touch with effect of oxide particles on mechanical, thermo-mechanical properties, as well as their impact on dielectric and conductivity characteristics. Spectroscopic studies are one of the most important techniques that allow providing scientifically based prediction of mentioned materials properties. Particularly, when we speak about oxides that reveal luminescent behavior luminescent studies are of principal priority. The "polymer – oxides" composites, where oxides are capable to emit secondary light are attractive for applications as effective components of white light emission diodes, solar elements, etc.

Various RE-doped (RE = Eu, Sm, Pr) phosphates, vanadates, germinates and compounds with compose molecular anions (e.g. phosphate - molybdates, vanadates - molybdates, etc. were selected by us as luminescent compounds. The micro/nano sized powders of those oxides were synthesized by spontaneous crystallization, high temperature solid state reaction, co-precipitation and sol-gel methods.

Several polymers were used as matrixes and micro-cellulose was one of them.

The morphology of powders and composites was monitoring using optical, SEM and AFM microscopy. The photo-luminescence (PL) properties were taken at wide range of the exciting light wave lengths and in wide temperature range 4.2 – 300 K. Obtained results confirmed made previously predictions about perceptiveness of studied "polymer – oxide" composites for future applications.