Optical and mechanical properties of cellulose-based nanocomposites embedded with luminescent oxides

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Cellulose and its derivatives can be used as an alternative to plastics in electronics. Related HT technology is called as "paper electronics". An incorporation of some dopants/fillers into the cellulose matrix allows developing advanced composites, and nanocomposites are among them, suitable for the opto-electronics needs, e.g. for elaboration of luminescent materials, etc [1].

Cellulose matrix can be filled with luminescent particles, carbon or semiconductor quantum dots, coordination complexes, or inorganic phosphors in order to transform the absorption and emission properties of the material.

Here we studied hybrid cellulose based nanocomposites containing simultaneously Ca $CaAl_2O_4$:Eu,Dy; $SrAl_2O_4$:Eu,Dy, and $Sr_{0.95}Ca_{0.05}(SO_4)$:Mn oxides. The noted composites revealed long-lasting photo- and mechano-luminescence with the spectral bands mainly extended in blue, green and red regions of the light, respectively. The samples containing $LiTaO_3$:Pr oxide also showed a red color long-lasting photo- and mechano-luminescence. If to combine the emissions of the noted oxides with intrinsic – blue luminescence of cellulose, it is possible to perform white emission of such a composite system. Concentration dependencies of intensity, spectra, and decay of the luminescence of such produced cellulose composites were studied. Correlation of optical, including luminescent, and color characteristics with mechanical properties of the composites has been discussed, too.

The developed cellulose-based materials can be useful as substrates in flexible paper electronics or as active light-transforming elements of optical devices.

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