Highly luminescent polycarbonate films doped with diaquatris(thenoyltrifluoroacetonate)europate(III) complex - UV exposition effect

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In this work we report the preparation, characterization, thermal and luminescence properties of highly luminescent polycarbonate (PC) polymer films. The diaquatris(thenoyltrifluoroacetonate)europium(III) complex [$Eu(tta)_3(H_2O)_2$] in doping concentration at 1, 2, 5, 7 weight % was incorporated in the PC polymer for PC-Eu TTA material. Thermogravimetry analysis (TGA) showed no weight loss in the range of 333–473 K for the polymeric systems confirming the interaction between the polymer matrix and the Eu^{3+}-complex via replacing of the water molecules in the complex precursor by the carbonyl groups along the polymer backbone. Evaluation of the photophysics stability showed the influence of the UV wavelength exposition on doped polymer. Differential scanning calorimetry (DSC) showed no significant changes in T_m for the exposed film samples, however crystallinity is affected by non combined complex in the polymer chains. In the infrared spectra the peaks related to the H_2O vibrational modes in the europium β-diketonate are not found in the PC systems, suggesting interaction between the carbonyl groups in PC and the Eu^{3+} ion by replacing of H_2O molecules. The changes in the areas of fitted FTIR spectral curve for each component peak are gradually changed with the increase of doping concentration. The observation of characteristic emission bands arising from the $^5D \rightarrow {}^7F_J$ transitions (J=0–4) dominated by the hypersensitive $^5D \rightarrow {}^7F_2$ transition at around 614 nm of Eu^{3+} ion indicate the incorporation of the Eu^{3+} ions in the system. With the film of 5% doping concentration of the Eu^{3+} complexes showing the highest luminescence intensity among all samples.Luminescence quenching is observed in PC Eu TTA7%. During uv exposition the quantum efficiency increased up to 6h of exposition, while evidences in the FTIR spectra showed degradation of the polymer backbone.This suggests that chain scission of PC can recombine in new oxidativegroups and react with theEu^{3+}-complex.