Polymer Based Clay Quantum Dot Multifunctional Nano-materials: Synthesis and Characterization

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Abstract Nanotechnology can provide a multitude of improvements and new solutions to the polymeric material. Polymer based clay–quantum dot multifunctional nano-hybrids were synthesized using the solution intercalation method. The inclusion of inorganic fillers in a polymer improves its mechanical strength, anti-flammability, dimensional stability and other properties. With the selection of appropriate fillers, existing properties of the polymer can be enhanced or new properties can be acquired that is not usually associated with the polymer. Fundamental limits in clay composition prevent them from being used easily in applications requiring electrical/thermal conductivity or optical applications. Therefore, Multi nano-fillers, organoclay and quantum dots, were used yielding nanocomposite with enhanced mechanical, flammability, thermal, electrical and optical properties – allowing it to be a drop-in replacement for many different materials while keeping other properties intact. The dispersion of nanosized fillers (nanofillers) in the polymer is often the most challenging and crucial problem. Nanofillers tend to aggregate due to strong van der Waals attraction, which makes it necessary to develop strategies to overcome this attraction. End functionalization strategy was adopted to develop various interactions among the phases. Hydrophillic nature of montmorillonite clay was changed into organophillic by ion exchange method using various intercalating agents with different functionality and chain lengths. These modifications were carried out in order to have good compatibility, uniform and homogenous dispersion of clay and quantum dots in the polymer matrix. These intriguing new polymer composites based on clay-quantum dots will combine the favorable emission characteristics with excellent mechanical properties. The polymer based clay-quantum dot materials with high photoluminescence (PL) efficiency will be promising for use in future optoelectronic devices such as light emitting devices, aerospace applications and solar cells.

Figures

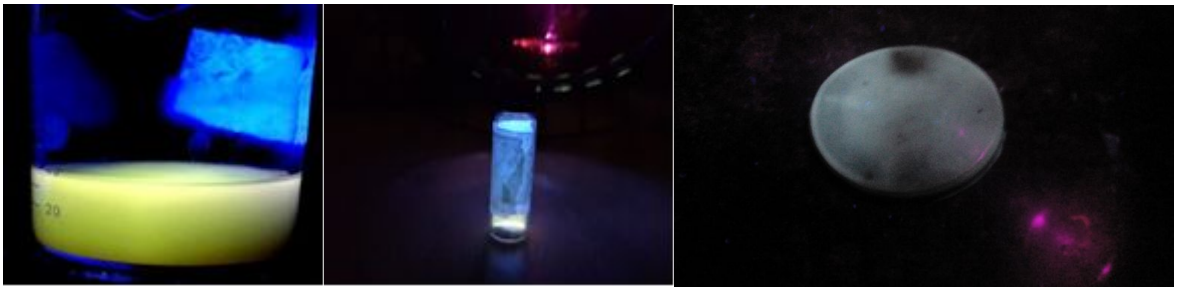

Fig. Yellow luminescence under UV excitation for the solution, quantum dots and fabricated films with quantum dots and organoclay as nanofillers