LUMINESCENCE SPECTROSCOPY AND ITS APPLICATION

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Scintillation is an example of radioluminescence wherein the absorption of high-energy radiation or particles leads to observable light. Inorganic scintillators are extensively employed as radiation detector materials in many fields of applied and fundamental research, such as medical imaging, high-energy physics, astrophysics and nuclear materials detection for homeland security, as well as other applications. Wide band-gap crystals doped with RE^{3+} which possesses nanosecond VUV luminescence due to d-f electronic interconfigurational transitions are considered as one of the most promising VUV scintillators for gamma detectors. The field of scintillator research has become a very active one during the last two decades.

In solid state lighting (SSL) the light is emitted by solid-state electroluminescence, as opposed to incandescent bulbs or fluorescent tubes. Compared to incandescent lighting, SSL creates visible light with reduced heat generation or parasitic energy dissipation. It is contemplated as an efficient lighting technology that offers a lot of potential to save energy. Solid state lighting utilizes LEDs or light emitting diodes. From this point of view a lot of research has been directed towards synthesizing good quality phosphors which can efficiently absorb UV light given by LED to emit desired colors.

Luminescence spectroscopy is powerful tool to perform material analysis. Particularly, photoluminescence (PL) and cathodoluminescence (CL) are well-known methods that yield useful data on energetic positions of defect and impurity levels. Complementary information on the energetic barriers (trap depths) influencing the transfer and recombination of trapped charge carriers are obtained from thermally stimulated luminescence (TSL) spectroscopy that has been applied in investigation of defect formation in wide-gap maerials for a long time.

Synchrotron Radiation with its broad and intense spectrum is considered to be one of the best tools as an excitation source for luminescence spectroscopy. Pulsed mode of SR allows one to make time-resolved measurements, which is essential for decay measurements. In our research we apply this technique to have best spectral and temporal resolution, also to perform measurements in extreme conditions – low temperatures, high vacuum, etc.

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