

Extended reliability of Graphene coated phosphors for white light emitting diode applications

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Owing to its superior thermal and chemical stability over oxides, several Oxynitride phosphors is being investigated for phosphor converted light emitting diodes. (pc-LEDs) [1-2]. However due to the lack of non-reliability of these phosphors, none of them have found suitable for commercial applications. One of the serious issues that are faced by white LED manufacturers is reduction of the emission intensity from the phosphors that has been used for down converting GaN based UV/blue LED light which arouse due to the poor thermal stability of these phosphors used. [1-2] Due to the unusual high thermal conductivity graphene, single sheet of carbon atom packed in honeycomb lattice can be used as thermal management material in many optoelectronic devices[3-5]. Here, reduced Graphene Oxide coating on $\text{Sr}_{0.53}\text{Ba}_{0.4}\text{Si}_2\text{O}_2\text{N}_2:\text{Eu}_{0.07}^{2+}$ phosphors were realized and the effect of coating on structural, luminescent and stability/reliability characteristics were studied. Various concentrations of GO were used to coat the sample. Scanning electron microscope and high resolution microscope image analysis confirms graphene coating over phosphor particles. High quality graphene layers have been coated over the phosphor. The PL emission intensity slightly decreases with the coating. White LEDs were fabricated using uncoated, annealed and coated phosphor at various temperatures. The long term reliability of the phosphor, tested under 85 °C and 85 % relative humidity shows high reliability and stability of the phosphor when compared to uncoated phosphor.

References

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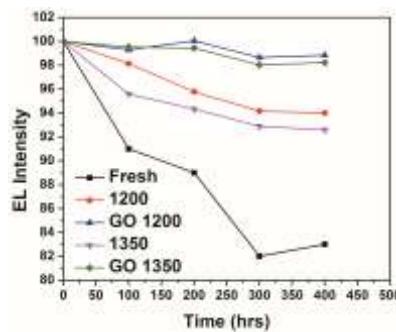


Figure 1. Variation of EL emission intensity with time

Table 1. Optical characteristics of the White LEDs fabricated using coated and uncoated phosphors

Phosphor	CIE x	CIE y	CCT (K)	Efficacy (lm/W)	Luminance (lm)	CRI Ra
Fresh	0.3404	0.3779	5263	117	75	59.5
1200 °C	0.3201	0.3372	6077	108	69	63.4
1350 °C	0.3302	0.3546	5594	94	60	65.6
GO1200 °C	0.3186	0.3472	6109	98	63	70
GO 1350 °C	0.3246	0.3543	5827	89	57	62